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IOWA STATE JOURNAL OF SCIENCE
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THE GRASSES OF IOWA[1]

Richard W. Pohl[2]

ABSTRACT. An illustrated taxonomic treatment of the Iowa grasses, with keys to genera and species and discussions of structure, variation, seasonal and ecological occurrence, geographic distribution and chromosome numbers. Distribution maps are provided for all species. A total of 71 genera containing 199 species and named hybrids are found in the state. These represent primarily grasses of the deciduous forest and the tall grass prairie, with smaller representation of species of the loess bluff steppe, northern bog forests, and the coastal plain.

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Introduction

Because of the great extent of prairie in the original vegetation of Iowa, and the large importance of grasses in our agriculture, the study of agrostology received early attention in the state. Professor L. H. Pammel undertook, during the closing decade of the nineteenth century, a large-scale study of the Iowa grasses, which appeared in two volumes. The first of these, published in 1901, was Bulletin No. 1 of the Iowa Geological Survey, and was entitled "The Grasses of Iowa, Part I." This volume, under the authorship of L. H. Pammel, J. B. Weems, and F. Lamson-Scribner, was a treatise on the economic botany of the grasses of the state. It contained chapters on seed testing, cereals, plant pathology, agronomy, weeds, lawns, and plant chemistry. The second volume, issued in April, 1905, is entitled "The Grasses of Iowa, Part II," and is the work of L. H. Pammel, Carleton R. Ball, and F. Lamson-Scribner (cited herein as PBS). It appeared as a Supplementary Report of the Iowa Geological Survey for 1903. This volume is a taxonomic treatment of the grasses of the state, with illustrations, keys, descriptions and distribution maps. While the nomenclature is outdated, the completeness of the work makes it a valuable reference for any later studies in midwestern agrostology.

Since the turn of the century, the vast expanses of prairie have disappeared from the Iowa scene, and the state now probably has a higher percentage of cultivated land than any other. Numerous new grasses

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have been discovered in the state, either as previously overlooked natives, or as new weeds and crop plants. Many changes in nomenclature necessitated by more recent studies, and greatly increased knowledge of the distribution of species within our boundaries, make a new treatment of the grasses of Iowa desirable at this time.

This publication is based primarily upon herbarium specimens in the herbaria of Iowa State University (ISC) and the State University of Iowa (IA). No species has been admitted to the treatment unless voucher specimens were found and examined. A limited number of specimens were borrowed from the U.S. National Herbarium to validate reports of species listed for Iowa by Hitchcock (1935) and Hitchcock and Chase (1951). The distribution of each species has been mapped, and illustrations of most species have been provided.

Most of the illustrations are by Mrs. Elsie H. Froeschner, whose painstaking work is gratefully acknowledged. The illustrations of spikelets of the genus Panicum and certain other figures were taken from The Manual of the Grasses of the United States, by permission of Dr. Jason R. Swallen, Head Curator of the U.S. National Herbarium. Dr. G.H.M. Lawrence of the Rachel Hunt Library of the Carnegie Institute, Pittsburgh, has kindly provided negatives of the original illustrations from this work. To these persons, and to the many others who have helped from time to time in the preparation of this paper, the author wishes to extend his sincere thanks.

Chromosome numbers have been listed for a majority of the taxa involved. The symbol S is used to indicate the somatic or "2N" number, and G to denote the gametic or "N" number. The chromosome numbers have been obtained from the literature sources cited. A few numbers derived from the author's unpublished work are also given.

Grasses in the Iowa Vegetation

Iowa lies at the meeting place of several major vegetational formations. The great body of the deciduous forests of North America lies to the east of the state, but forests of this type are well represented in the eastern portions of Iowa and extend, in attenuated form, up the river valleys across the state. The tall grass prairie of the central United States centered in Iowa, although it has been virtually wiped out within our boundaries by agricultural operations. Originally, most of the uplands in central and western Iowa were dominated by this vegetational type. The drier slopes and loess bluffs of the Missouri drainage were occupied by more xeric vegetation related to that of the western Great Plains. These three types of vegetation have contributed the largest number of species to the Iowa grass flora. Small numbers of species represent outliers of northern forest and bog vegetation, and of species common on the Atlantic and Gulf coastal plains, which have migrated into the interior during Post-Pleistocene time.

The following lists indicate characteristic species of the major types of habitats existing within the state. Inasmuch as all of these habitat types blend into one another, the lists are not mutually exclusive.

Upland Forest

Agrostis perennans
Brachylelytrum erectum
Bromus kalmii
B. pubescens
Danthonia spicata
Elymus riparius
E. villosus
Festuca obtusa
Hystrix patula
Melica nitens
Muhlenbergia sobolifera
M. tenuiflora
M. sylvatica
Oryzopsis racemosa
Panicum clandestinum
P. implicatum
P. latifolium
Poa sylvestris
P. wolfii
Schizachne purpurascens

Lowland Forest

Agrostis perennans
Bromus purgans (=latiglumis)
Cinna arundinacea
Diarrhena americana
Elymus virginicus
Leersia virginica
Muhlenbergia frondosa

Lowland Prairie

Agropyron trachycaulum
Agrostis alba
Andropogon gerardii
A. hallii
Bromus purgans (= latiglumis)
Calamagrostis canadensis
Elymus canadensis
E. virginicus
Eragrostis spectabilis
Festuca paradoxa
Hierochloë odorata
Leptoloma cognatum
Muhlenbergia racemosa
Panicum implicatum
P. praecocius
P. scriberianum
P. leibergii
P. virgatum
Sorghastrum nutans
Spartina pectinata
Sphenopholis obtusata
S. obtusata var. major
Sporobolus heterolepis
Tripsacum dactyloides

Dry Prairie and Loess or Gravel Hills

Agropyron smithii
Agrostis scabra
Agrostis hyemalis
Andropogon scoparius
Aristida basiramea
A. dichotoma
A. oligantha
A. longiseta
Bouteloua curtipendula
B. gracilis
B. hirsuta
Calamovilfa longifolia
Festuca octoflora
Koeleria cristata
Muhlenbergia cuspidata
Panicum depauperatum
P. linearifolium
P. perlongum
P. wilcoxianum
Sporobolus asper
S. cryptandrus
Stipa spartea
S. viridula

Marsh, Fen, Bog, Wet Shores

Agrostis palustris
Alopecurus aequalis
Beckmannia syzigachne
Bromus ciliatus
Calamagrostis canadensis
C. inexpansa
Echinochloa walteri
Eragrostis frankii
E. hypnoides
Glyceria borealis
G. grandis
G. septentrionalis
G. striata
Leersia lenticularis
L. oryzoides
Leptochloa fascicularis
Muhlenbergia glomerata
M. mexicana
Phalaris arundinacea
Phragmites communis
Scolochloa festucacea
Zizania aquatica

Meadows, Pastures, and Lawns

X Agrohordeum macounii
Agropyron cristatum
A. desortorum
A. elongatum
A. intermedium
A. repens
Agrostis alba
Arrhenatherum elatius
Bromus inermis
Dactylis glomerata
Festuca arundinacea
F. elatior
F. ovina
Hordeum jubatum
H. pusillum
Lolium perenne
Miscanthus sacchariflorus
Muhlenbergia schreberi
Phalaris arundinacea
Phleum pratense
Poa annua
P. compressa
P. pratensis
P. palustris
P. nemoralis

Weeds of Cultivated Fields and Waste Ground

Aegilops cylindrica
Agropyron repens
Alopecurus carolinianus
Aristida oligantha
Avena fatua
Bromus commutatus
B. inermis
B. japonicus
B. secalinus
B. tectorum
Cenchrus longispinus
Dactylis glomerata
Digitaria ischaemum
D. sanguinalis
Echinochloa muricata
E. crusgallii
Eleusine indica
Eragrostis capillaris
E. cilianensis
E. pectinacea
E. pilosa
E. poaeoides
Hordeum jubatum
Panicum capillare
P. dichotomiflorum
Phalaris canariensis
Setaria faberi
S. lutescens
S. verticillata
S. viridis
Sorghum halepense
Sporobolus neglectus
S. vaginiflorus

The Structure of Grasses

Duration

Perhaps the majority of grasses are perennial, but large numbers of annual types are found as well.

Stature

Because grasses are monocots, and lack cambial activity, their total height is somewhat restricted. Our grasses range in height from a few centimeters in Poa annua to 2 to 4 meters in such species as Andropogon gerardii, Spartina pectinata, and Phragmites communis. Most grasses are ordinarily less than two meters tall. The tropical bamboos may reach 30 meters or more in height, but culms of such stature are produced only by old clumps with large food reserves.

Roots

The grass root system is typically fibrous. The primary root is usually of short duration, and all subsequent roots are adventitious from lower culm nodes. The total linear extent of the roots must be very large, but individual roots are of small diameter.

Recent investigations of Row and Reeder (1957) have shown that the position and orientation of root hairs may have taxonomic significance. Typical festucoid grasses have root tip epidermis with alternating long and short cells. Only the short cells produce root hairs, which tend to point toward the tip of the root. Panicoid and eragrostoid grasses have root epidermis composed of equal cells, all of which may produce root hairs. In this case, the hairs tend to be perpendicular to the long axis of the root. These features may be observed by examining fresh water-mount slides of growing root tips.

Stems

Grass stems may be roughly classified as repent or erect. Repent stems include the rhizomes of many perennial species, and the stolons of such species as Agrostis palustris and Eragrostis hypnoides. A few species, such as Cynodon dactylon, produce both rhizomes and stolons.

Most grass stems are fundamentally erect. Flowering stems are known as culms. Leafy, nonflowering basal shoots, prominent in such perennial species as Poa pratensis, are called innovations. They may contribute greatly to the thickness and verdure of the turf.

When the culms of grasses are knocked down by the wind, they tend to erect themselves over a period of a few days. This process is caused by the unequal growth of an organ called a pulvinus. The pulvinus is a swollen and meristematic area at the base of the internode. In festucoid grasses, the pulvinus is made up of sheath tissue, but in the panicoid and eragrostoid groups it may consist of both stem and leaf tissues (Brown et al. 1959A).

Festucoid grasses have hollow stem internodes, but eragrostoid and panicoid grasses usually have internodes which are solid or nearly so (Brown et al. 1959B). Corn is a good example of the latter group.

Leaves

Grass leaves are borne singly at the nodes, and are two-ranked or distichous, that is, placed 180 degrees apart in the vertical plane. The typical grass leaf consists of three distinct structures, the sheath, ligule and blade.

The leaf sheath surrounds the culm internode. Typically, it is in the form of a split tube with overlapping margins. If a given leaf has the left margin of the sheath overlapping the right margin, then the next leaves above and below it will overlap in the opposite fashion. In a few genera, notably Bromus, Dactylis, Melica, and Glyceria, the margins of the sheath are united, as in the Cyperaceae. The edges of the sheath at its apex may be prolonged into little projecting points, called auricles, They do not seem to have any function, but are often used as aids in identification.

At the juncture of the leaf sheath and blade, a projecting membrane or ring of hairs, called the ligule, is found. Festucoid grasses usually have membranous ligules, while those of eragrostoids and panicoids are frequently ciliate or composed of hairs. Ligules seem to have little functional importance, but often provide distinctive characters for identification.

The leaf blade of most grasses is attached directly to the summit of the sheath. In the grasses of the temperate zone, the blade is characteristically linear and acuminate. The midrib is conspicuous and frequently protrudes beneath. The margins of the blade are often hardened and provided with microscopic barbs.

The surfaces of leaf sheaths and blades, as well as those of the bracts of the spikelets, may be covered with various types of hairs. The larger and more visible of these provide good marks of recognition in many cases.

At the base of each vegetative branch of a grass stem, there is found a curiously modified, bladeless leaf known as a prophyllum. This structure is H-shaped in cross section and lies between the main stem and the branch. It has no midrib, but contains two principal vascular bundles, situated at the two junctures of the cross-bar of the H. The prophyllum clasps the branch with two of its flanges, and the main stem with the other two. Thus it strengthens the inherently weak V-joint between the culm and the branch.

Many features of the microscopic anatomy of the leaf epidermis and cross-section appear to have phylogenetic significance. Prat (1932) has shown that festucoid, eragrostoid, and panicoid grasses can be distinguished by their leaf epidermis. Microscope slides for such studies are best prepared from a portion of the uppermost culm blade. The portion of the blade nearest the sheath is most fully differentiated. Fresh, preserved, or dried leaves may be used, but the latter should be soaked in a detergent solution (Pohl, 1965) before use. The leaf is placed on a firm surface, abaxial surface down, and scraped with a razor blade until some of the lower epidermis is free of mesophyll. An alternative method of preparation, suited to the manufacture of numbers of slides, is to boil the leaf blades in diluted nitric acid briefly until the epidermis is freed. The resultant peels are then washed in water and neutralized with ammonium hydroxide. Small portions of the lower epidermis are

then mounted, external surface upward, in water or detergent solution for microscopic examination. These preparations may be stained, dehydrated, and permanently mounted in synthetic resin. The distinctive features of festucoid, eragrostoid, and panicoid leaf epidermis are stated below.

Subfamily	Microhairs	Stomata	Silicified or suberized cells
Festucoideae	Single cells	Oblong or elliptical	Single or in pairs of one round silica cell, one reniform suberized cell
Eragrostoideae	Bicellular, obovoid, the upper cell short, blunt	Rhombic	Often numerous, in rows; axe-head, knuckle-bone, or quadrilateral shape
Panicoideae	Bicellular, linear, acute; cells equal; cushion-based hairs frequent	Rhombic	As in Eragrostoideae

The cross-sectional anatomy of leaf blades similarly may be useful in distinguishing the major phylogenetic groupings of the Gramineae. Permanent microscope slides of leaf cross-sections are best for study, but much can be learned from hand-sections of fresh leaves. These can be cut in elder pith with a razor blade and mounted in water or dilute iodine-potassium iodide solution. The three common subfamilies of grasses can be distinguished from cross sections by the following features.

	Festucoideae	Eragrostoideae	Panicoideae
Arrangement of mesophyll cells	irregular	radial around each bundle	irregular to somewhat radial
Bundle sheaths	double	double	single

Inflorescences

Grasses do not bear their flowers singly, as most other plants do, but in scaly-bracted clusters called spikelets. While we use ordinary taxonomic terminology to describe grass inflorescences, the terms are used in a different sense. Thus, in most plants we speak of "a panicle of flowers," whereas in discussing a grass we say "a panicle of spikelets."

The commonest type of grass inflorescence is the panicle, which may be open or extremely condensed. Such very reduced panicles as those of timothy (Phleum pratense) can only be differentiated from true spikes by a careful examination of the branching pattern. The grass panicle arises from a peduncle, or stalk. The central axis, or rachis, may bear branches which may again branch. The main branches of the inflorescence may be spread at flowering time by bulbous pulvini in their

axils. No bracts are visible at maturity, although vestiges of bracteal leaves are produced during the early development of the inflorescence. The ultimate branchlets of the inflorescence are termed pedicels, although in actuality they are miniature peduncles of the spikelets.

True spikes are less common than panicles, and are found mostly in the Triticeae and Chlorideae. The spike of the Triticeae is balanced or equilateral, having spikelets borne on opposite sides of the rachis. Those of the Chlorideae are one-sided, all spikelets being borne on the lower side of the rachis.

Racemes of spikelets are said to be rare in grasses, but a number of genera have them. The so-called "spikes" of Leptochloa, Paspalum, Digitaria, and other genera are in reality racemes in which the spikelets have short pedicels.

A final type of inflorescence may be described, which resembles a spike in having some spikelets sessile upon the rachis, and a raceme in having others pedicellate. Such inflorescences are found in Hordeum jubatum and in the genus Andropogon. The term rame, from the Latin ramus, a branch, is useful to describe such structures.

Spikelets

Terminating the ultimate branchlets of grass inflorescences are diminutive scaly-bracted structures containing the flowers. These are the spikelets, the ultimate units of the inflorescence (Fig. 1). Much of the evolution of the grasses has involved modification of the structure, size, and position of the spikelets, so that no comprehensive definition of the term can be made which will cover all grasses. Typically, a simple grass spikelet is composed of the following parts:

Rachilla. The central axis of the spikelets, to which the other parts are attached.

Glumes. These are two sterile bracts, borne at the base of the rachilla. They are designated as the first, or lower, and the second, or upper glume. Like all foliar appendages of grasses, they are spaced 180 degrees apart on the rachilla, and at successive nodes, separated by a very short internode.

Florets. These are the flowering units of the spikelet. One is borne at each node of the rachilla. Successive florets, like glumes, are on opposite sides of the rachilla.

The floret consists of an outer bract, the lemma, which is borne on the rachilla, a flower, and an inner bract, the palea, borne on the extremely short floral branch. Thus the lemma and the palea are on axes of different orders. Neither one is a part of the flower. The lemma, like the glumes, is homologous with a foliage leaf. Since the flower is a modified branch system, the palea is then the first leaf of the flower-branch. It is homologous with the prophyllum in vegetative branches, and similar to it in structure.

The lemma in grasses is leaf-like in possessing a midrib, with a variable number of vascular bundles or "nerves" on either side of it. The midrib may extend beyond the body of the lemma as an awn or beard. Occasionally the lateral nerves may be extended as awns, as in the genus Tridens. The summit of the lemma may be extended into "teeth" at the base of the awn, as in Avena and Bromus.

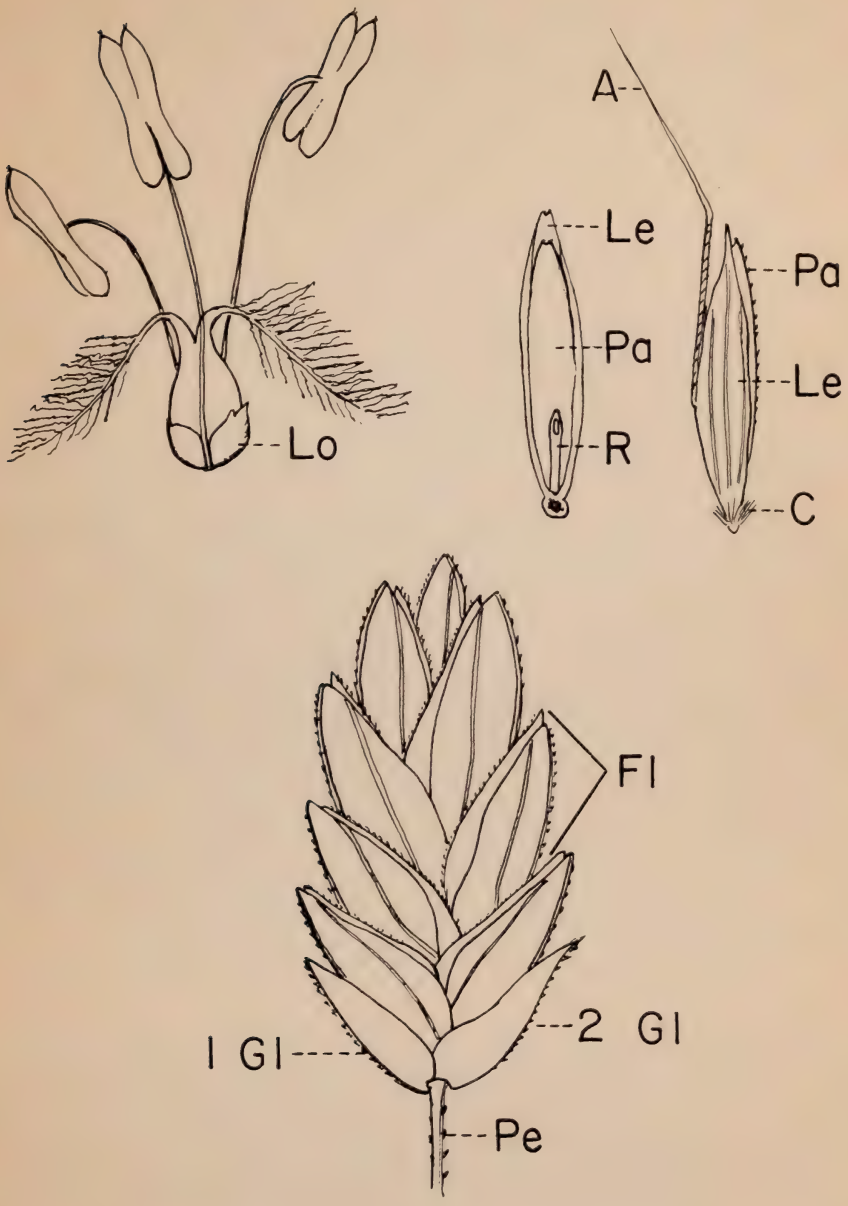


Figure 1. Grass spikelet. 1 Gl = first glume, 2 Gl = second glume, Pe = pedicel, Lo = lodicule, A = awn, Fl = floret, Le = lemma, Pa = palea, R = rachilla, C = callus.

The base of the floret, and probably some associated parts, may be modified into a hard or sharpened structure called a callus, as in Stipa and Aristida. Such structures assist in the natural planting of the grain, and may also cause injury to grazing livestock.

The palea, like its homologue, the prophyllum, is two-keeled and lacks a midrib. Except during anthesis, it serves to cover and conceal the grain. The presence of a palea is one of the features which distinguish grasses from sedges.

The grass flower, concealed by the lemma and palea, consists of the lodicules, stamens, and pistil. The lodicules are two minute bodies lying between the pistil and the lemma. They become turgid and force the lemma outward at flowering time, thus permitting the escape of the anthers and the exposure of the stigmas. At other times they are very inconspicuous. Arber (1934) interpreted the lodicules as the vestiges of a corolla. While this interpretation may be open to some doubt, it is probable that they represent some portion of the perianth.

The shape of the lodicules may be of systematic importance. Those of festucoid grasses are ovate, acute, and sometimes mitten-shaped. Those of eragrostoid and panicoid grasses are truncate, short, and often thickened. Lodicules are most easily observed in flowering grasses. By dissecting the florets while they are open, it is possible to see lodicules in the turgid condition.

Stamens

Common temperate-zone grasses have three stamens. Bamboos and a few other species have six or even more. The stamens have very delicate filaments which droop, the relatively large anthers dangling. The anthers are attached at the base, but both base and apex are deeply lobed. Since most grasses are wind pollinated, dense pollen showers are common, and much springtime hay fever may be attributed to grass pollen.

A relatively small number of grasses are cleistogamous, having flowers which are self-pollinated within closed florets. Barley, wheat, oats, Stipa, Aristida, Sporobolus, Festuca (Vulpia), and the rosette-forming species of Panicum behave in this way. The cleistogamous habit has great importance in determining the genetic structure of species, since it tends toward the formation of numerous inbred local races.

Pistil

The grass pistil typically has two plumose stigmas, arising separately at the apex of the ovary. In some species, styles are evident, and in the bamboos, three stigmas are present. Most authors interpret the pistil as being composed of three carpels (Schuster, 1910; Arber, 1934) even though there are but two stigmas and a single ovule. Barnard (1957) believes that the pistil of wheat is composed of four carpels. The single ovule fills the locule of the pistil, and its growth distends the ovary wall. In the process, the seed coats are crushed. The mature fruit is a caryopsis, a single-seeded dry indehiscent fruit with the ovary wall adherent to the seed. Ordinarily the ovary wall is very thin and membranaceous, but in the woodland grass, Diarrhena americana, it becomes coriaceous and is detached from the seed. In the genera Sporobolus and Heleochloa,

the mature pericarp becomes gelatinous when wet, and the seed may be extruded. This device serves to distribute the seed.

Grass embryos have been found to bear features of systematic importance, although too difficult of observation for use in practical identification. The common subfamilies are distinguished by the following embryo characteristics.

	Festucoideae	Eragrostoideae	Panicoideae
Lower limb of scutellum	absent	present	present
Epiblast	present	present	absent
Mesocotyl	very short	elongated	elongated
First embryonic leaf	margins approximate; vascular bundles few	margins approximate; vascular bundles few	margins overlapping; vascular bundles many

Seedlings

Seedlings of festucoid grasses tend to have a narrow, elongated vertical first leaf. Those of panicoids usually have broad, short, horizontal first leaves. Seedlings of eragrostoids are somewhat intermediate.

Disarticulation

The dissemination of the fruits and seeds of grasses depends upon the detachment of spikelets or spikelet parts from the parent plant. Grass spikelets disarticulate, or become detached in several ways. Most festucoid and eragrostoid grasses disarticulate above the glumes, which remain on the pedicel. The remainder of the spikelet usually further disarticulates into individual florets, each of which carries with it the rachilla internode which originally supported the floret above. Panicoid grasses characteristically disarticulate below the glumes. The entire spikelet drops from the plant, leaving the naked pedicel behind. A few grasses in the various subfamilies disarticulate in other ways. Side-oats grama, for example, drops entire spikes, and sandbur sheds burs which contain spikelets.

Compression

Festucoid and eragrostoid grasses ordinarily have spikelets which are laterally compressed, that is, flattened from the side, so that the glumes and lemmas are U- or V-shaped in cross-section. A few grasses have spikelets which are terete or round in cross-section. Panicoid grasses have dorsally compressed spikelets which are flattened from the backs of the glumes and lemmas.

Spikelet modifications

A simple grass spikelet possesses two glumes and a number of florets, all of which are more or less similar except in size. A number of variations on this general type occur. The commonest of these is the reduction of some florets. In festucoid and most eragrostoid grasses, the

uppermost florets may be reduced to sterile rudiments, or variously modified into awned or conspicuous structures. The ultimate in reduction of this type is a single-flowered spikelet, which may sometimes have a rachilla joint prolonged behind the palea. In panicoid grasses, however, there is only a single, terminal, perfect-flowered floret, with a sterile or staminate floret below it. Such spikelets normally possess two glumes, although the first may be very much reduced in size or absent.

GRAMINEAE Juss. GRASS FAMILY

Annuals or perennials; cespitose, stoloniferous, or rhizomatous; stems with conspicuous nodes, leaves alternate, distichous, composed of a sheath with usually overlapping edges, an elongated blade with parallel venation, and a membranous or hairy collar, the ligule, protruding at the summit of the sheath. Inflorescences terminal on the culm or on branches, either paniculate, spicate, or racemose; flowers small, wind-pollinated, assembled in short scaly spikes, the spikelets; each flower borne between two bracts, the lemma and palea; flower usually consisting of two perianth segments (lodicules), three stamens, and a tricarpellary pistil bearing two plumose stigmas. Fruit a caryopsis, except in rare instances.

Classification

The classification of the grass family is currently in a state of flux. The traditional systems of the past, as exemplified by that used by Hitchcock (1935, 1950) are based almost exclusively on gross characteristics of the inflorescence and spikelet. Recent work in grass anatomy and cytology has cast doubt on some of the groupings of Hitchcock and other previous authors. Characteristics of apparent phylogenetic importance have been found in the leaf epidermis and leaf cross-section, chromosome number and size, nature of the starch grains, the persistence of nucleoli during nuclear divisions, the structures of root tips and root hairs, stem apices, embryos and seedlings, the nature of the pulvini, the reaction of the seedlings to certain herbicides, and other features. A number of new systems of classification using some or all of these characteristics have been proposed. The most comprehensive of these is the system offered by Stebbins and Crampton (1961), which is based largely upon an earlier publication by Stebbins (1956). This system is followed as to the grouping of tribes into subfamilies in the present paper, since the author feels that it represents a closer approach to the actual phylogenetic relationships of the grasses than previous systems. The order of the subfamilies has been altered by the author, and other minor alterations have been made. Undoubtedly, this system itself will be superseded by others as more knowledge of the grasses is developed. Unfortunately no clear definition of the various subfamilies and certain of the tribes is possible on the basis of easily recognized external characteristics. Therefore, the general key to Iowa grasses has been designed to separate genera, rather than subfamilies or tribes.

Key to the Genera of Iowa Grasses

1. At least some of the spikelets contained in bony, bead-like structures or spiny burs. 2
1. Spikelets never concealed in bony or spiny coverings 4
2. Spikelets contained in spny burs. . . . . 64. Cenchrus
2. Spikelets not in spiny burs. 3
3. Low, stoloniferous plants, usually 20 cm or less tall. 54. Buchloë
3. Tall plants, 1-3 m tall, not stoloniferous. . . . . 69. Tripsacum
4. Spikelets of two strongly different kinds, one staminate, the other pistillate or perfect. 5
4. Only one type of spikelet evident; flowers usually perfect. . 8
5. Low creeping plants; staminate spikelets in one-sided spikes; pistillate spikelets in bony involucres. . . . . 54. Buchloë
5. Plants erect, tall, not creeping. 6
6. Staminate spikelets in a terminal tassel; pistillate ones on an ear, concealed by husks. . . . . 70. Zea
6. Staminate and pistillate spikelets in a single inflorescence. 7
7. Aquatic plants; terminal portion of panicle bearing erect awned pistillate spikelets; basal portion with drooping awnless staminate spikelets. . . . . 40. Zizania
7. Land plants; staminate and perfect-flowered spikelets intermixed. . . . . 67. Sorghum
8. Spikelets with a single perfect or pistillate floret. . . . 9
8. Spikelets with 2—many perfect or pistillate florets . . . 51
9. Entire spikelet, including the glumes and sometimes a rachis internode, falling from the plant when ripe. 10
9. Fertile floret dropping from the glumes when ripe. 30
10. Inflorescence composed of one or more elongated spikes or racemes. 11
10. Inflorescence a panicle of spikelets, rarely a panicle of short racemes. 21
11. Spike single, terminal on the culm. 12
11. Spikes 2—many on each culm, often forming a terminal panicle. 14
12. Rachis fringed with white hairs; spikelets paired, a sessile perfect spikelet and a stalked sterile one attached at each node. . . . . 66. Andropogon
12. Rachis not fringed; spikelets 1—3 per node. 13
13. Spikelets in trios, the central one fertile, the lateral two reduced and usually sterile. . . . . 26. Hordeum
13. Spikelets paired and sessile at the base of the spike, usually single or with three glumes above, all sterile. 27. X Agrohordeum
14. Spikes when mature breaking up into single joints, each carrying a pair of spikelets. 15
14. Spikes not breaking up at maturity. 16
15. Both spikelets of each pair on pedicels; inflorescence fan-shaped; the spikelets covered with silky white hairs. 65. Miscanthus
15. One spikelet of each pair sessile and fertile, the other pedicellate and sterile; inflorescence not silky. . 66. Andropogon
16. Spikelets laterally compressed, the glumes keeled. . . . 17
16. Spikelets dorsally compressed, the glumes flattened. . . 19

17. Spikelets circular; glumes concealing the floret; plants annual, tufted. . . . . 18. Beckmannia
17. Spikelets lanceolate; floret visible; plants perennial; tufted or rhizomatous. 18
    18. Spikelets with an awned rudimentary floret above the fertile floret. . . . . 53. Bouteloua
    18. Spikelets without rudimentary florets. . . . . 55. Spartina
19. Spikelets with a cup-like projection at the base, formed of the first glume and a rachilla joint. . . . . 58. Eriochloa
19. Spikelets without a projecting base. 20
    20. Fertile floret hard, the margins of the lemma rolled under. . . . . 62. Paspalum
    20. Fertile floret soft, the margins of the lemma thin, not rolled under. . . . . 60. Digitaria
21. Panicle dense, cylindrical, spike-like, with overlapping spikelets. 22
21. Panicle open or somewhat contracted, never spike-like. . . . 24
    22. Spikelets dorsally compressed, interspersed with numerous soft bristles. . . . . 63. Setaria
    22. Spikelets laterally compressed, not interspersed with bristles. 23
23. Spikelets U-shaped; midribs of the glumes protruding; lemma awnless. . . . . 17. Phleum
23. Spikelets ovate; midribs of glumes not protruding; lemma awned. . . . . 16. Alopecurus
    24. Spikelets laterally compressed. 25
    24. Spikelets dorsally compressed. 27
25. Spikelets with 2 florets, the upper staminate, awned. . 12. Holcus
25. Spikelets with a single floret. 26
    26. Spikelets with 4 bracts (glumes, lemma, palea). . 15. Cinna
    26. Spikelets with 2 bracts only (lemma and palea); true glumes reduced to minute ridges at the tip of the pedicel. . . . . 39. Leersia
27. Each spikelet accompanied by a hairy sterile pedicel which arises at its base. . . . . 68. Sorghastrum
27. Spikelets not accompanied by sterile pedicels. 28
    28. First glume minute or lacking; fertile floret soft-textured, the margins of the lemma thin, exposed. . . 61. Leptoloma
    28. First glume at least 1/4 as long as the spikelet; fertile floret hard, the margins of the lemma rolled in. 29
29. Spikelets awned or the fertile lemma apiculate. . 59. Echinochloa
29. Spikelets not awned. . . . . 57. Panicum
    30. Spikelets borne in spikes. 31
    30. Spikelets borne in open or congested panicles. 35
31. Spikelets borne on both sides of the rachis; spikes solitary, terminal. . . . . 26. Hordeum vulgare
31. Spikelets borne only on the lower side of the rachis; spikes several-many, digitate, racemed or panicled. 32
    32. Lemma awned or lobed at the tip. 33
    32. Lemma not awned or lobed. 34

33. Spikes numerous, slender, forming a panicle. . . . . 52. Chloris
33. Spikes 1-3, oblong. . . . . 53. Bouteloua
34. Rachilla prolonged beyond the fertile floret; spikes whorled; plants with rhizomes and stolons. . 50. Cynodon
34. Rachilla not produced beyond the floret; plants tufted; spikes in a panicle. . . . . 51. Schedonnardus
35. Lemma bearing 1 or 3 awns. 36
35. Lemma awnless. 42
36. Floret hard-textured, cylindrical or nearly so; plants tufted. 37
36. Floret soft, laterally compressed. 40
37. Lemma bearing 3 awns. . . . . 38. Aristida
37. Lemma bearing only 1 awn. 38
38. Glumes much shorter than the lemma. . . 33. Brachyelytrum
38. Glumes longer than the lemma. 39
39. Awn strongly twisted near the base, firmly attached to the lemma. . . . . 34. Stipa
39. Awn not twisted, readily deciduous. . . . . 35. Oryzopsis
40. Floret awned at the tip or awnless; callus hairs much shorter than the lemma. . . . . 47. Muhlenbergia
40. Floret awned from the back. 41
41. Floret single, surrounded by a tuft of hairs as long as the lemma. . . . . 14. Calamagrostis
41. Florets 2, the lower staminate, the upper perfect, neither surrounded by long hairs. . . . . 11. Arrhenatherum
42. Floret surrounded by a tuft of long white callus hairs. . . . . 46. Calamovilfa
42. Floret glabrous or somewhat hairy, never bearing hairs as long as the lemma. 43
43. Floret hard and shining. 44
43. Floret soft-textured. 45
44. Floret laterally compressed, pubescent. . . . 28. Phalaris
44. Floret dorsally compressed, glabrous. . . . . 63. Setaria
45. Fertile floret subtended by two large basal staminate florets, all three falling from the glumes as a unit. . . . 29. Hierochloë
45. Fertile floret solitary, without adhering sterile or staminate ones. 46
46. Both glumes longer than the floret. 47
46. One or both glumes shorter than the floret. 49
47. Glumes awned or awn-tipped. 48
47. Glumes not awned. . . . . 13. Agrostis
48. Spikelets U-shaped, the glumes truncate and with protruding awned midribs; panicle spike-like; plants tufted, the culm bases bulbous. . . . . 17. Phleum
48. Spikelets not U-shaped; glumes acute to caudate-acuminate; culm bases not bulbous; plants tufted or rhizomatous. . . . . 47. Muhlenbergia
49. Ligule a membrane; lemma 3-nerved. . . . . 47. Muhlenbergia
49. Ligule a fringe of short hairs; lemma 1-nerved. 50

50. Prostrate annual, with thick, short, thimble-shaped panicles, partly enclosed by the dilated upper sheath. . . . 49. Heleochloa
50. Annuals or perennials; panicles exserted or if enclosed in the sheaths, then very slender. . . . . 48. Sporobolus
51. Inflorescence composed of 1 or more spikes. 52
51. Inflorescence an open or congested panicle. 62
52. Spike single, terminal, bearing spikelets on both sides of the rachis. 53
52. Inflorescence of several to many unilateral spikes, the spikelets all borne on the lower side of the rachis. 60
53. Glumes reduced to short stubs or lacking. . . 25. Hystrix
53. Glumes evident, usually more than half as long as the spikelets. 54
54. Rachis breaking up into single internodes when ripe, each bearing one or more spikelets. 55
54. Rachis remaining intact, the florets dropping from the glumes. 57
55. Rachis joints greatly thickened at the upper end, the single spikelet partially sunken into it. . . . 21. Aegilops
55. Rachis joints thin, flat. 56
56. Spikelets 1-2 per node, all sessile and alike, 1-2 flowered, sterile. . . . . 27. X Agrohordeum
56. Spikelets 3 per node, the lateral two somewhat pedicellate; florets 1-2, sterile. . . . . 24. X Elyhordeum
57. Spikelets one at each node of the rachis. 58
57. Spikelets 2 or more at each node. . . . . 23. Elymus
58. Spikelets placed flatwise to the rachis, both glumes developed. 59
58. Spikelets placed edgewise to the rachis, only one glume present except in the terminal spikelet. . . . . 3. Lolium
59. Glumes linear, shorter than the 2 florets; rachilla prolonged above the florets as a naked bristle; lemmas ciliate on the keel. . . . . 22. Secale
59. Glumes lanceolate to oblong or ovate; spikelets 3-several flowered; lemmas not ciliate. 60
60. Glumes broadly ovate, less than twice as long as wide; grain free, readily dropping from the floret at maturity; cultivated annuals. . . . . 20. Triticum
60. Glumes lanceolate, acute, more than twice longer than wide; grain permanently enclosed by the floret; perennials. 19. Agropyron
61. Spikes numerous, very slender, forming a panicle. . . . . 43. Leptochloa
61. Spikes few, thick, digitate. . . . . 42. Eleusine
62. Disarticulation below the glumes. 63
62. Disarticulation above the glumes. 64
63. Florets 2; second glume obovate. . . . . 9. Sphenopholis
63. Florets 3 or more; glumes similar. . . . . 30. Melica
64. Glumes as long as the entire spikelet. 65
64. Glumes shorter than the florets. 69
65. Lemmas awnless. 66
65. Lemmas awned. 67
66. The two lower florets staminate, larger than the fertile terminal floret. . . . . 29. Hierochloë

66. Lower florets reduced to minute sterile appendages, much smaller than the fertile floret. . . . . 28. Phalaris
67. Florets 4 or more. . . . . 36. Danthonia
67. Florets 2 or 3. 68
68. Florets 2 or 3, all similar and fertile; plants annual. . 10. Avena
68. Florets 2, the lower one staminate, with a straight awn; the upper one perfect, with a bent awn; perennials, with bulbous bases. . . . . 11. Arrhenatherum
69. Lemmas 3-nerved, the nerves usually conspicuous. . . 70
69. Lemmas with 5-many usually inconspicuous nerves. . . 74
70. Rachilla covered with long, silky hairs which surround and conceal the florets. . . . . 37. Phragmites
70. Rachilla not long-hairy. 71
71. Nerves of the lemma hairy; lemmas with 1-3 awns or short points. 72
71. Nerves of lemma glabrous. 73
72. Upper edges of the palea ciliate; panicle small, mostly concealed in the upper sheath. . . . . 45. Triplasis
72. Upper edges of palea not ciliate; panicle large, exserted 44. Tridens
73. Lemmas stiff; caryopsis large, with a protruding beak; plants rhizomatous. . . . . 7. Diarrhena
73. Lemmas soft; caryopsis small, concealed, not beaked; plants not rhizomatous. . . . . 41. Eragrostis
74. Florets 2. . . . . 8. Koeleria
74. Florets 3 or more. 75
75. Lemmas with a well-developed awn. 76
75. Lemmas awnless or with short awn points. 78
76. Callus bearded with straight, erect hairs. . . . . 31. Schizachne
76. Callus not bearded. 77
77. Awn from the undivided tip of the lemma. . . . 2. Festuca
77. Awn from the back of the lemma, or arising between 2 teeth. . . . . 1. Bromus
78. Veins of lemma parallel, conspicuous; sheaths closed; plants of moist ground or water. . . . . 32. Glyceria
78. Veins of lemma converging toward the summit; sheaths open or closed. 79
79. Callus of lemma bearded. 80
79. Callus not bearded. 81
80. Callus hairs straight, erect. . . . . 4. Scolochloa
80. Callus hairs cobwebby, crimped. . . . . 5. Poa
81. Panicle with few, stiff, straight branches, the spikelets sessile in dense clusters at their tips. . . . . 6. Dactylis
81. Panicle much-branched; spikelets on pedicels. 82
82. Sheaths closed; plants rhizomatous. . . . . 1. Bromus
82. Sheaths with overlapping edges; plants tufted or rhizomatous. . 83
83. Plants rhizomatous; dioecious. . . . . 56. Distichlis
83. Plants tufted; flowers perfect. 84
84. Low annuals, 10-20 cm tall; nerves of lemmas silky. . . . 5. Poa
84. Perennials, 50-100 cm tall; lemmas glabrous. . . . 2. Festuca

SUBFAMILY I. FESTUCOIDEAE

TRIBE 1. FESTUCEAE

1. BROMUS L.

Annuals or perennials; cespitose or rarely rhizomatous; sheaths with united edges; spikelets several- to many-flowered; rachilla disarticulating above the glumes and between the florets; lemmas rounded or compressed-keeled, usually awned from between the teeth of the bifid apex, rarely short-awned or awnless, 5-9 nerved. Our representatives of the genus include a number of native woodland species, some weedy introduced annuals from the Old World, and the valuable introduced smooth brome, B. inermis.

Knowles, P. F. 1944. Interspecific hybridizations of Bromus. Genetics 29:128-140.

Wagnon, H. K. 1950. Nomenclatural changes in Bromus. Rhodora 52:209-215.

_____. 1952. A revision of the genus Bromus, sect. Bromopsis, of North America. Brittonia 7:415-480.

Key to Species

1. Lemmas broad, rounded or tapered to the apex, with short acute lateral teeth; callus not sharp and prolonged

    2. First glume 1-nerved; glumes lanceolate to narrowly ovate; native perennial species of woodlands and stream banks (except the introduced rhizomatous B. inermis)

        3. Plants rhizomatous; panicle erect, the branches and spikelets strongly ascending; spikelets linear-lanceolate, glabrous; lemmas awnless or with short awn-tips; introduced perennial, naturalized along roads and on waste ground 1. B. inermis

        3. Plants not rhizomatous; panicles nodding or with drooping branches; spikelets drooping; lemmas awned; native perennial species of woodlands, thickets and stream banks

            4. Lemmas pubescent along the margins only, glabrous or slightly scaberulous across the back; culms with 3-7 nodes. . . . . 2. B. ciliatus

            4. Lemmas sparsely to densely pubescent over the back, sometimes more densely so near the margins and base

                5. Culms with 10-20 nodes; sheaths mostly longer than the internodes, bearing prominent auricles at the summit; anthers 1.5-2.8 mm long

6. Sheaths glabrous or nearly so. . . . . 4. B. purgans

6. Sheaths villous. . . . . 4A. B. purgans f. incanus

5. Culms with 3-7 nodes; sheaths shorter or longer than the internodes; auricles lacking.

7. Panicle short, mostly 9-12 cm long, contracted, nodding anthers 1.5-2.6 mm long; first glume 3-nerved. 5. B. kalmii

7. Panicle open, lax, mostly 15-30 cm long; anthers 2.8-4.6 mm long; first glume 1-nerved. . . . . 3. B. pubescens

2. First glume 3-5-nerved; glumes broadly ovate to elliptical; weedy annuals.

8. Spikelets glabrous or scabrous.

9. Mature lemmas involute-margined, thus exposing the rachilla, often short-awned or awnless; sheaths glabrous or the lowermost sparsely hairy. . . . . 6. B. secalinus

9. Mature lemmas not involute, overlapping and concealing the rachilla; awns well-developed; sheaths pubescent.

10. Spikelets narrowly lanceolate, 3-5 mm wide when mature; branches of panicle elongate, very slender and flexuous; lower sheaths densely covered with soft white hairs which droop toward the ends and often become matted or tangled. . . . . 9. B. japonicus

10. Spikelets narrowly ovate to oblong, 5-8 mm wide when mature; branches of panicle ascending to drooping at maturity, not flexuous; lower sheaths sparsely to rather densely covered with straight, spreading to retrorse white hairs. . . . . 7. B. commutatus

8. Spikelets pubescent.

11. Panicle dense, erect, the spikelets ascending, overlapping and concealing the rachis; weedy annual of disturbed ground. . . . . 8. B. mollis

11. Panicle nodding, with drooping spikelets; rachis exposed; native perennial species of forest land. . . . . 5. B. kalmii

1. Lemmas narrowly lanceolate, with a hard, sharp callus; lateral teeth of lemma acuminate, very thin. . . . 10. B. tectorum

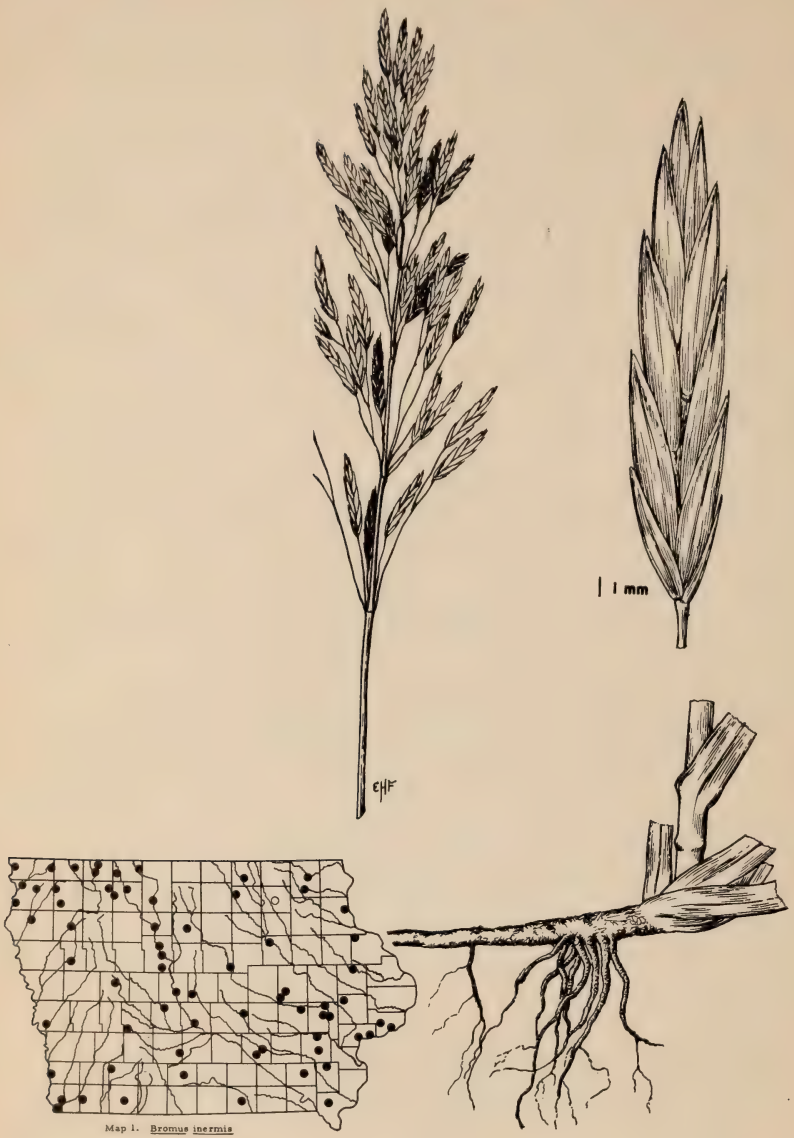


Figure 2. Bromus inermis

1. B. inermis Leyss. Smooth brome. Fig. 2; Map 1.

Widely cultivated and frequently escaping to roadsides, railroad rights-of-way and waste ground; throughout the state. End of May-July.

Chromosome number S=56 (Bowden, 1960A), S=56, 42 (Knobloch, 1943), S=70 (Neilsen, 1939), S=28 (Wagnon, 1952).

Figure 3. Bromus ciliatus

2. B. ciliatus L. Fig. 3; Map 2.

Rare; low wet ground and swamps; northeastern Iowa. August-September. Chromosome number S=14 (Wagnon, 1952; Bowden 1960A). A specimen cited by PBS as B. ciliatus var. laeviglumis is ordinary B. ciliatus.

Newfoundland to Washington, south to New Jersey, Pennsylvania and Tennessee; Ohio and westward to Nebraska; Rocky Mountain region, westward to the Pacific Coast.

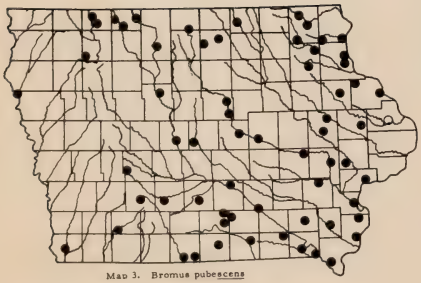


Figure 4. Bromus pubescens

3. B. pubescens Muhl. ex Willd. Fig. 4; Map 3.
(B. purgans of Am. auth., not L.)

Common; dense or rocky woods; probably throughout the state. June-early July. Chromosome number S=14 (Wagnon, 1952). A form with glabrous sheaths and another with glabrous lemmas occur but have not as yet been found in Iowa.

New Hampshire to Alberta, southward to Florida and Arizona.

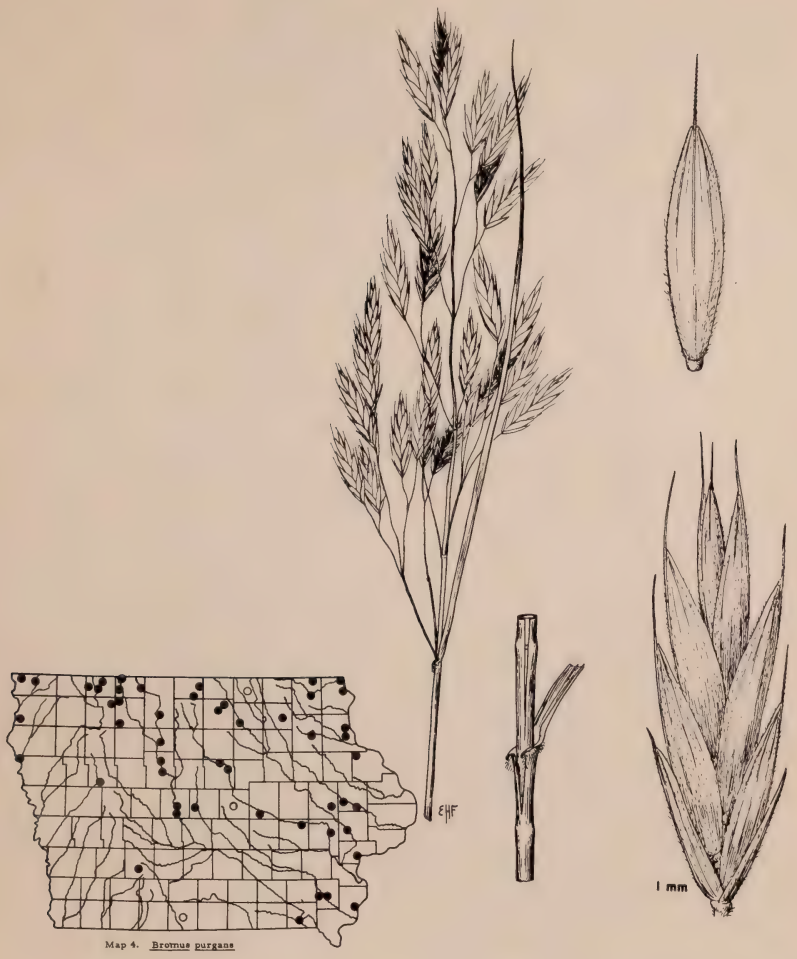


Figure 5. Bromus purgans

4. B. purgans L., f. purgans Fig. 5; Map 4.

B. purgans latiglumis (Scribn.) Shear.

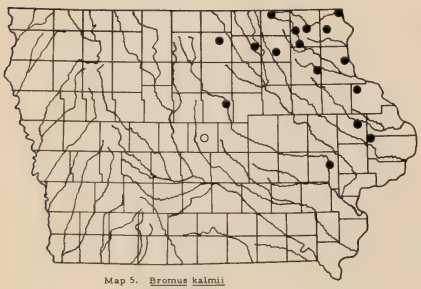
Common; alluvial woodlands, stream banks, prairies; probably throughout the state; apparently our most common native brome. August-September. Chromosome number S=14 (Wagnon, 1952). Most of our specimens have smooth sheaths, in strong contrast to the situation in the eastern U.S., where f. incanus is more prevalent.

Maine to Montana, southward to North Carolina and New Mexico.

4A. B. purgans, f. incanus (Shear) Stat. nov.

(B. purgans incanus Shear U.S.D.A. Div. Agrost. Bull. 23:41 (1900).

Apparently rather rare and mostly restricted to the northeastern portion of the state.



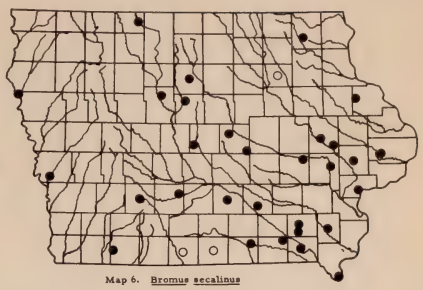
Map 5. Bromus kalmii

Figure 6. Bromus kalmii

5. B. kalmii A. Gray. Fig. 6; Map 5.

Rare; rocky banks and woodlands; mostly restricted to the northeastern quarter of the state. July. Chromosome number S=14 (Wagnon, 1952; Bowden, 1960A).

Maine to South Dakota, southward to northern Iowa and western Maryland.



Map 6. Bromus secalinus

Figure 7. Bromus secalinus

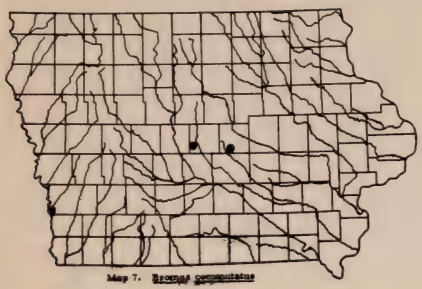
6. B. secalinus L. Chess, Cheat Grass Fig. 7; Map 6.
Grainfields and waste ground; throughout the state. June-early July. Chromosome number S=28 (Knowles, 1944).
Widespread as a weed in the United States; introduced from Europe.

9

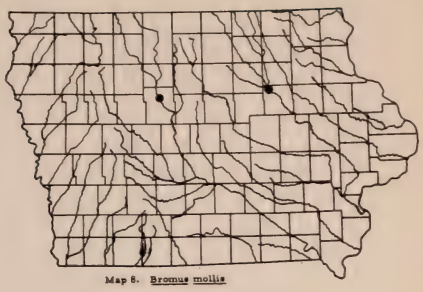
8

Figure 9. Bromus mollis

Figure 8. Bromus commutatus



Map 7. Bromus commutatus



Map 8. Bromus mollis

7. B. commutatus Schrad. Fig. 8; Map 7.

B. racemosus, var. commutatus of PBS.

Cultivated fields and waste places; apparently rare in Iowa. Late May-early July. Specimens apparently representing depauperate forms of this species were once cultivated at Iowa State College and are preserved in the University Herbarium. They form part of the basis of reports of B. racemosus from Iowa (under the name of B. hordaceus var. glabrescens).

Iowa specimens referable to this species include the following:

Marshall Co.: Van Cleve, July 1, 1898, W.M. Warden (ISC); Pottawattamie Co.: Council Bluffs, July 4, 1895, L.H. Pammel (ISC); Story Co.: College Park, May 20, 1896, F. Rolfs (ISC); Ames, June 14, 1897 L.H. Pammel (ISC).

Chromosome number S=28 (Knowles, 1944).

Widespread as a weed in eastern, northern and western U.S. Apparently this species is much more common on the west and east coasts than it is here, where its place is taken by B. japonicus.

8. B. mollis L. Fig. 9; Map 8.

B. hordaceus of PBS.

Rare, waste and cultivated ground. This species is known from Iowa only by the following specimens. Its occurrence here was probably only as a passing waif, since no recent collections have been made.

Black Hawk Co.: Cedar Falls, July 9, 1896, G. W. Carver (ISC); Webster Co.: Fort Dodge, no date, F.W. Paige (ISC).

Reports by PBS of this species from Ames could not be verified.

Nova Scotia to North Carolina, westward to South Dakota; Rocky Mountain and Pacific Coast States. Introduced from Europe.

9. B. japonicus Thunb. Japanese Brome Fig. 10; Map 9.
(including var. porrectus Hack.)
B. patulus Mert. and Koch

Roadsides, waste ground and cultivated fields; probably common throughout the state. June-July.

This rather handsome weedy brome has had a confusing nomenclatural history in Iowa grass literature. Iowa specimens which the author has seen and which belong to this species have been cited in published accounts as B. arvensis, B. patulus, B. mollis, B. racemosus, B. hordaceus var. glabrescens, and B. squarrosus. Study of much European and United States material has convinced me that B. arvensis does not exist in the United States or is very strictly confined to certain small areas in the East. Most material cited under this name is merely straight-awned B. japonicus (var. porrectus Hack.). B. arvensis from Europe has anthers 3-4 mm long and usually purple spikelets; B. japonicus has small anthers, 1-2 mm long, and usually green or stramineous spikelets. In recent years, seed has appeared on the market labeled "Bromus arvensis" or "field brome." I have not seen plants grown from such seed and cannot comment on its identity. B. squarrosus is a rare European adventive and I have seen no Iowa specimens.

In the eastern states, most B. japonicus appears to have straight awns, while much Iowa material has divaricate awns. There is some evidence that this difference is merely due to the degree of maturity of the plants and the dryness of the growing season, rather than to a genetic difference in the plants.

Chromosome number S=14 (Moriya and Kondo, 1950).

Throughout the United States, except in the southeastern states. In the Midwest, this species is more common than B. commutatus; the reverse appears to be true in the East. Introduced from the Old World.

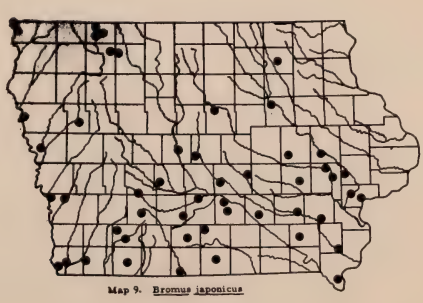
10. B. tectorum L. Downy Chess Fig. 11; Map 10.

Roadsides, cultivated fields, waste ground; probably common through Iowa. Mid-May-July. This is probably our commonest weedy brome. Like the other annual species, it dries up early, is shallow-rooted and has little forage or erosion control value. The sharp awn and pointed callus of the florets may inflict injuries to animals, especially sheep. Var. glabratus Spenner, with glabrous lemmas, has been found at Ames.

Chromosome number S = 14 (Bowden, 1960A).

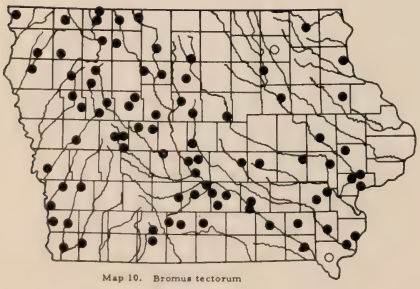
Throughout most of the United States except the southeastern states; introduced from Europe.

Figure 10. Bromus japonicus



Map 9. Bromus japonicus

Figure 11. Bromus tectorum



Map 10. Bromus tectorum

2. FESTUCA L. Fescue

Plants annual or perennial, tufted or rarely somewhat creeping; leaves flat, folded, or (in the section Vulpia) threadlike; inflorescence an open or reduced panicle; spikelets several-many flowered; disarticulation above the glumes and between the florets; lemmas narrow, 5-nerved, awned or rarely merely acute or acuminate; awn arising from the tip of the lemma, lateral teeth absent.

Key to Species

1. Leaves 2 mm or less wide, usually rolled, folded, or threadlike; lemmas awned

   2. Leaves threadlike; diminutive annuals with soft bases; florets cleistogamous, with a single minute anther; florets usually more than 5. . . . . 1. F. octoflora, var. tenella

   2. Leaves usually folded or rolled, not threadlike; perennials, forming hard tufts; florets open-pollinated; anthers 3; florets about 4-6

      3. Innovations arising within the whitish or pale brown persistent sheaths (intravaginal), the plants hence forming dense clumps. . . . . 6. F. ovina

      3. Innovations breaking through the sheaths at their bases and arising separately (extravaginal), often decumbent at the base, forming looser clumps than the preceding; basal sheaths thin, usually reddish brown, soon disintegrating into brown fibers. . . . . 7. F. rubra

1. Leaves flat, at least 3 mm wide; lemmas awnless or nearly so

   4. Spikelets 10-20 mm long; lemmas 5-7 mm long; panicle narrowly ovoid-cylindrical, contracted and spikelike after flowering, the shorter branches spikelet-bearing nearly to their bases

      5. Basal leaves stiff and coarse, prominently ridged above; rachilla internodes prominently upward-scabrous. . . . . 3. F. arundinacea

      5. Basal leaves smooth, lax, not prominently ridged; rachilla internodes smooth and glossy, rarely with one or two small barbs. . . . . 2. F. elatior

   4. Spikelets 8 mm or less long, lemmas mostly 3.5-5 mm long; panicle open, lax, nodding, the few usually long branches spikelet-bearing mostly above the middle

6. Principal lowermost branches of the panicle usually bearing 2-7 spikelets scattered along the outer half; spikelets narrowly ovate, 2-4 mm broad; rachilla joint attached to the lowermost floret more than 0.2 as long as the lemma; leaf blades lax; plants of woods. . . . . 4. F. obtusa

6. Principal lowermost branches of the panicle bearing 8-20 spikelets clustered near their ends; spikelets broadly ovate, 4-6 mm wide; rachilla joint attached to the lowermost floret usually less than 0.15 as long as the lemma; leaf blades firm; plants of prairie. . . . . 5. F. paradoxa

1. Festuca octoflora Walt., var. tenella (Willd.) Fern. Six-weeks fescue. Fig. 12; Map 11.
Vulpia octoflora (Walt.) Rydb.

Annual; shallow-rooted, in small tufts. This species is widespread but not common in Iowa. It occurs on sand plains and dry loess or gravel hills. Mid-May-early July.

This species, and a number of similar ones are sometimes segregated as the genus Vulpia. They are all characterized by extreme cleistogamy. In our material of F. octoflora, the flowers usually have a single tiny anther, about 0.2 mm long, closely appressed to the stigmas. Several collections, however, have two large anthers, up to 1.5 mm long, in some of the florets. The high degree of cleistogamy causes the formation of inbred local races, frequently differing slightly from each other. While our specimens are all of the short-awned extreme designated as var. tenella, they vary slightly in the degree of scabridity of the lemmas and the rachilla internodes.

Chromosome number S=14 (Gould, 1958, for var. glauca).

F. octoflora, in various forms, ranges throughout the U.S.

2. Festuca elatior L. Meadow Fescue Fig. 13B; Map 12.
F. pratensis Huds.

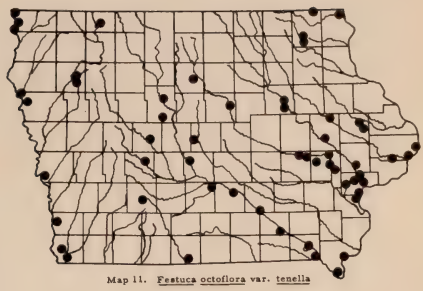
Perennial, tufted. Lawns, roadsides, damp meadows, waste ground. Meadow fescue, an introduction from Europe, is often used in lawn seed mixtures. While common in Iowa, it apparently does not long persist. Late May-early July.

Chromosome number S=14 (Bowden, 1960A).

3. Festuca arundinacea Schreb. Alta fescue, Kentucky 31 fescue. Fig. 13A; Map 13.

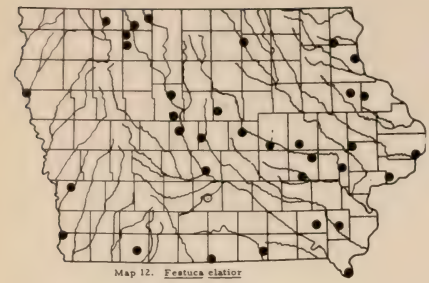
Perennial, tufted. Lawns, road embankments.

This species is closely related to meadow fescue, but is a hexaploid. The morphological differences between the two are largely of degree, rather than kind. In general, the plants are larger, coarser, and tougher than those of F. elatior. The leaves are thicker and stiffer, and are prominently ridged above. Our few specimens of this species are all from cultivated stands, and none dates back before 1952. The plant was introduced from Europe and has been in the U.S. since the nineteenth century. In several areas, notably the southeastern U.S. and the Pacific Northwest, F. arundinacea is used as a forage grass. In Iowa, it has

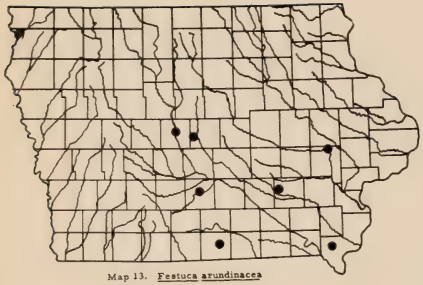


Map 11. Festuca octoflora var. tenella

Figure 12. Festuca octoflora, var. tenella



Map 12. Festuca elatior



Map 13. Festuca arundinacea

Figure 13. Festuca arundinacea A, F. elatior, B.

occasionally been planted to hold road embankments. The seed is sometimes sown to produce coarse lawns for athletic fields. When mixed with other species in lawn mixtures, the plants of this species tend to produce hummocks in a lawn, while the leaves lie horizontally on the ground. Therefore, this species should not be sown in mixture.

F. arundinacea has been found to cause occasional poisoning of cattle in the U.S. and other countries. The disorder, called "fescue foot," closely resembles ergot poisoning. (Huffman et al., 1956; Jacobson et al., 1963).

Chromosome number S=42 + 0-2 B (Myers and Hill, 1947).

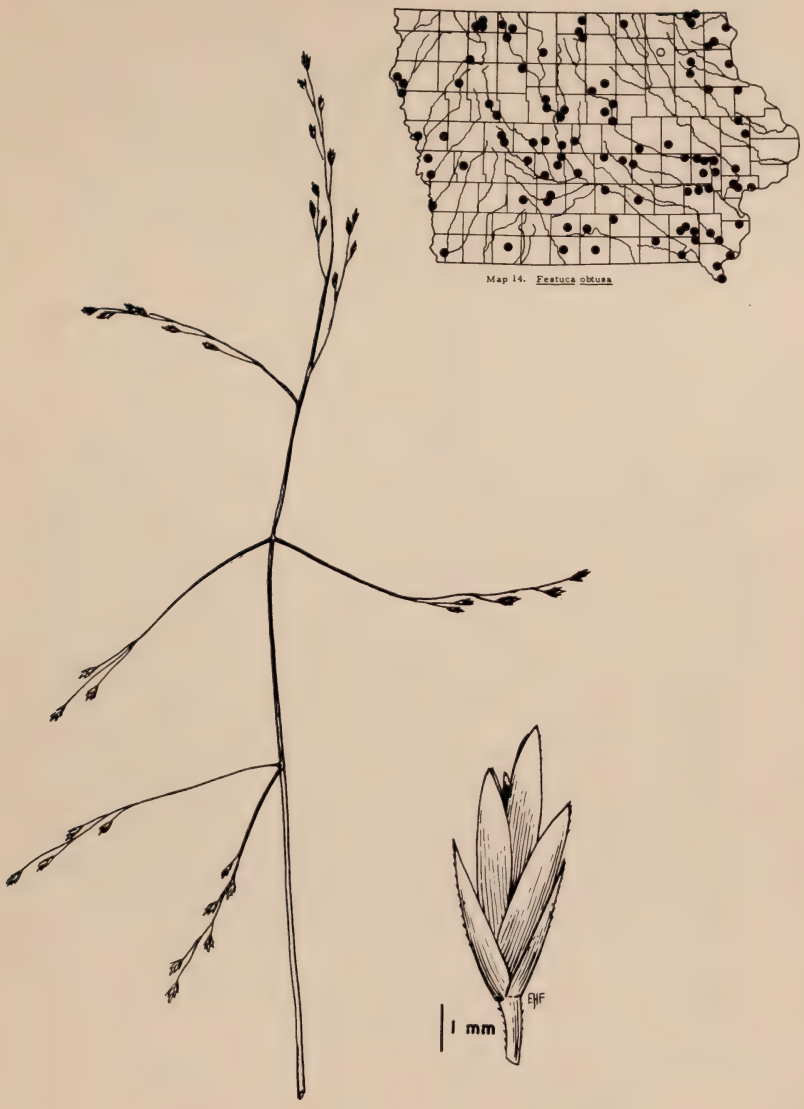


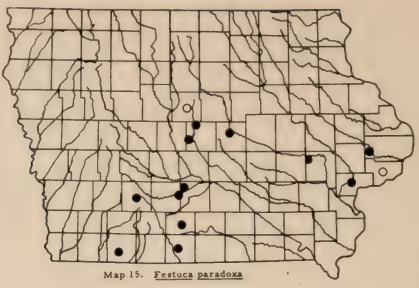
Figure 14. Festuca obtusa

4. Festuca obtusa Biehler Fig. 14; Map 14.

Perennial, in scattered small tufts. Common in moist woods, throughout the state. Mid-May-July.

Chromosome number S=42 (Bowden, 1960A; Pohl, unpublished)

Quebec to northern Florida, westward to Manitoba and eastern Texas.



Map 15. Festuca paradoxa

Figure 15. Festuca paradoxa

5. Festuca paradoxa Desv. Fig. 15; Map 15.

Prairies; rare or overlooked; central, south-central, and eastern Iowa.

Pennsylvania to South Carolina, westward to Wisconsin, Iowa, and Texas.

Figure 16. Festuca ovina

6. Festuca ovina L. Sheep fescue Fig. 16; Map 16.

Perennial, forming raised tufts. This species is probably never deliberately planted, but occurs occasionally in lawns. It may become dominant in dry, neglected bluegrass lawns, particularly on steep slopes. It is widely distributed in Iowa, and probably much more common than our few herbarium records indicate. May-August.

Chromosome number S=14, 21, 28, 42, 35, 56, 70 (Darlington and Wylie, 1955).

F. ovina occurs natively in northern North America and in Eurasia. In many areas, however, including Iowa, the plants are probably introductions and presumably ultimately of European origin.

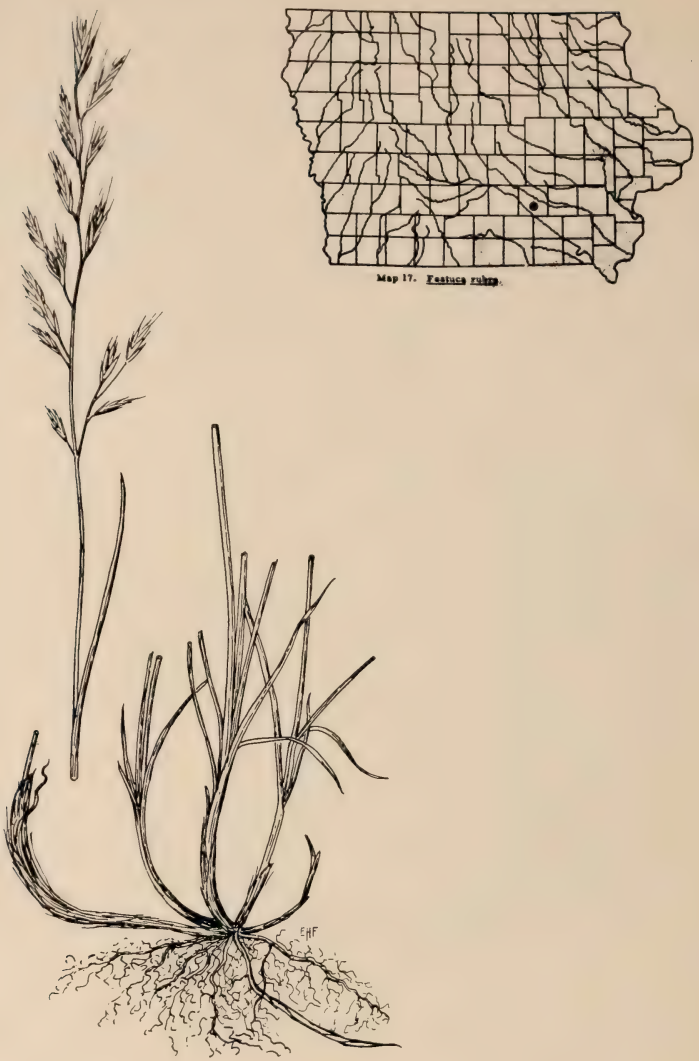


Figure 17. Festuca rubra

7. Festuca rubra L. Red fescue Fig. 17; Map 17.

Perennial, in loose sprawling tufts. Red fescue is a frequent component of lawn seed mixtures, but apparently does not persist or spread under our climatic conditions.

Chromosome number S=14, 28, 42, 56, 70, 46, 53, 64 (Darlington and Wylie, 1955); 42 (Bowden, 1960A).

Throughout the cooler and moister portions of North America and Eurasia, absent from the Great Plains.

3. LOLIUM L. Ryegrass

Plants annual or short-lived perennials, tufted; inflorescence a terminal balanced spike; spikelets single at each node, placed edgewise to the rachis; first glume absent in all but the apical spikelet; second glume placed opposite from the rachis; spikelets with several florets.

This genus has the appearance of members of the tribe Triticeae. However, the species never hybridize with any of the species of that tribe, but do form spontaneous hybrids with species of Festuca, which is apparently a close relative. Since all genera of the Triticeae, sensu strictu, hybridize freely, the absence of such hybrids with Lolium is taken to indicate its lack of close relationship with that tribe.

Key to Species

1. Glume not reaching to the top of the uppermost floret

   2. Lemmas awnless . . . . . 1. L. perenne

   2. Lemmas awned . . . . . 1a. L. perenne, var. italicum

1. Glume extending beyond the tip of the uppermost floret . . . . . 2. L. temulentum

1. Lolium perenne L. var. perenne Perennial ryegrass
Fig. 18; Map 18.

Annual or short-lived perennial in our climate. Widely planted as part of lawn seed mixtures and occasionally persisting or escaping from cultivation. This species is usually not perennial in our climate, because of its poor resistance to summer heat. Because of the cheapness of the seed, and the speed with which it germinates, it often comprises a considerable proportion of low-priced lawn seed mixtures.

Chromosome number S=14 (Tateoka, 1955).

Introduced from Europe.

1A. Lolium perenne, var. italicum Parn. Annual or common ryegrass
Map 19.

Common ryegrass is strictly annual, and is usually larger and more vigorous than typical L. perenne. It is a frequent component of lawn seed mixtures.

Chromosome number S=14 (Tateoka, 1955).

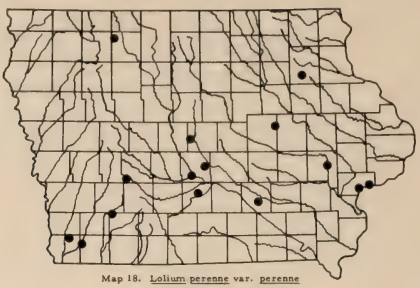
Introduced from Europe.

2. Lolium temulentum L. Darnel. Fig. 19; Map 20.

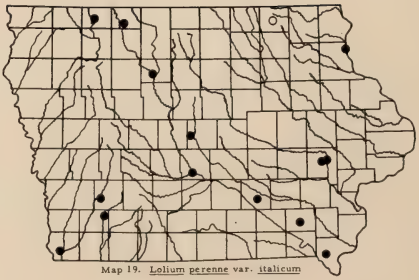
This species formerly occurred as a weed in wheat and oats, but has not been collected in Iowa since 1922. June-July. Awned and awnless forms occur. The plants are said to be toxic, but no definite toxic material has been isolated from them.

Chromosome number S=14 (Shibata, 1957).

Introduced from Europe.

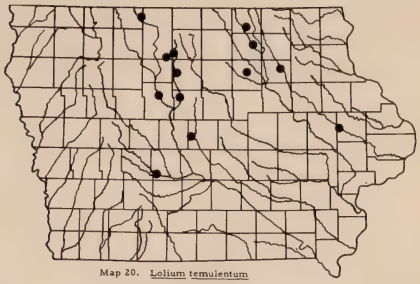


Map 18. Lolium perenne var. perenne



Map 19. Lolium perenne var. italicum

Figure 18. Lolium perenne



Map 20. Lolium temulentum

Figure 19. Lolium temulentum

4. SCOLOCHLOA Link

Perennials; rhizomatous, with spongy, succulent culms; panicles large, drooping; spikelets 3-4-flowered, with elongated glumes; lemmas erose or lacerate at the tip, bearing tufts of straight hairs on either side of the callus.

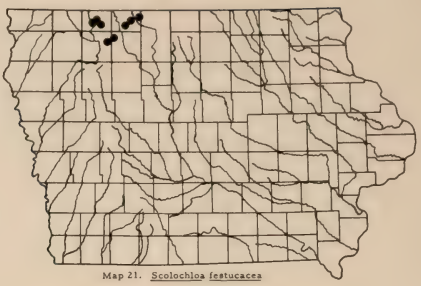
Scolochloa festucacea (Willd.) Link Fig. 20; Map 21.
Fluminea festucacea (Willd.) Hitch.

Locally common in sedge marshes and on wet lake shores in northwestern Iowa. The plants will grow in water up to two feet deep. Blooming occurs in the latter half of June and the spikelets shatter by early July. It is probable that this grass is more common than our records show, but the inaccessibility of the habitats and short blooming season cause it to be overlooked.

The plants are said to have some value as forage, forming part of marsh hay.

Chromosome number S=28 (Church, 1949).

Manitoba and Minnesota to northwestern Iowa and Nebraska, westward to British Columbia and eastern Oregon; northern Eurasia.



Map 21. Scolochloa festucacea

Figure 20. Scolochloa festucacea

5. POA L. Bluegrass

Plants usually perennial; cespitose or rhizomatous; leaf blades usually with blunt, boat-shaped tips; inflorescence a terminal panicle; spikelets several-flowered; lemmas awnless, 5-nerved, the intermediate nerves between keel and margin sometimes obscure; lemmas blunt or acute, usually pubescent on the keel or marginal nerves, mostly with a web of cottony hairs attached to the callus.

This is a large and important genus, containing many species of importance as lawn and pasture grasses and as native forage grasses in the western states. Presumably Poa is a very ancient genus, since it contains many species which are high polyploids, the chromosome numbers ranging from S=14 to S=147 in various species (Grun, 1954, 1955). Apomixis is very frequent in most species, resulting in the development of numerous races within species. These apomictic races differ markedly among themselves, and frequently cause great difficulty in delimiting species.

Key to Species

1. Some or all of the florets modified into bulblets. . . 9. P. bulbosa

1. Florets not modified into bulblets

   2. Lemmas without a web of cottony hairs on the callus

      3. Weak annuals without rhizomes; lemmas glabrous between the nerves . . . . . 2. P. annua

      3. Perennials with rhizomes; lower portion of lemmas pubescent between the nerves; rare, Lyon Co. . . 5. P. arida

   2. Lemmas with a web of cottony hairs attached to the callus

      4. Lemmas glabrous except for the web . . . . 6. P. languida

      4. Lemmas pubescent on the keel or marginal nerves or both

         5. Rhizomes present

            6. Culms flattened and keeled, usually single, without leafy tufts (innovations) at the base of the plants; intermediate nerves of lemmas obscure 3. P. compressa

            6. Culms round (in pressed specimens, at least the nodes remain round), usually in dense clumps, with abundant leafy innovations; intermediate nerves of lemmas evident . . . . . 4. P. pratensis

         5. Rhizomes absent (culm bases sometimes decumbent in P. palustris)

7. Dwarf, shallow-rooted, tufted annuals; culms 10-30 cm tall . . . . . 1. P. chapmaniana

7. Perennials; culms usually 30-150 cm tall

8. Panicle cylindrical, with short drooping lower branches; lemmas pubescent between the nerves on the lower portions . . . . . 7. P. sylvestris

8. Panicle pyramidal, lower branches not drooping; lemmas pubescent only on nerves and callus

9. Intermediate nerves of lemmas evident or conspicuous

10. Ligules 1-1.5 mm long. . . . . 8. P. wolfii

10. Ligules 2.5-7 mm long. . . . . 12. P. trivialis

9. Intermediate nerves of lemmas inconspicuous.

11. Lower panicle branches paired. . . 13. P. paludigena

11. Lower panicle branches usually 3 or more.

12. Ligules of culm leaves very short, usually less than 1 mm long, truncate; glumes acuminate . . . . . 10. P. nemoralis

12. Ligules of culm leaves 2.5 mm or more long, acute; lemmas usually bronzy near the tips; glumes acute. . . . . 11. P. palustris

1. Poa chapmaniana Scribn. Fig. 21; Map 22.

Slender tufted annual, resembling P. annua. This species is known from three localities in southern Iowa, listed below, but is probably considerably more frequent than our records show. Blooming mostly in May.

Johnson Co.: Sand along Iowa R., Iowa City. Hitchcock, 1889 (ISC); Louisa Co.: Morning Sun, G.W. Carver (ISC); Wapello Co.: Ottumwa, Pammel, 1899 (ISC).

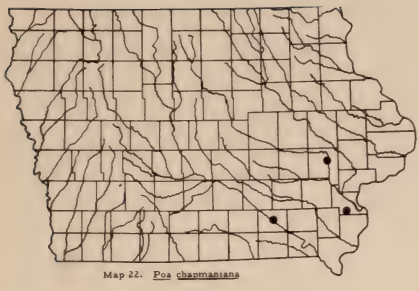
Massachusetts to Nebraska, southward to Florida and Texas.

2. Poa annua L. Annual bluegrass Fig. 22; Map 23.

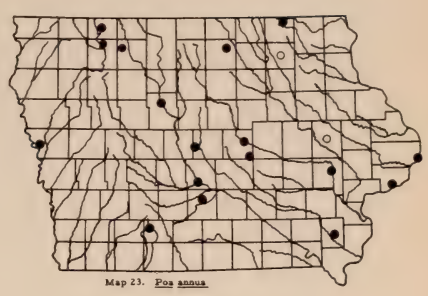
Annual; tufted; found in shaded lawns, on waste ground, especially in wet places. The small plants have a light green coloration and are rather soft and succulent. Annual bluegrass begins growth in fall or spring. It develops seed rather early and the plants usually die at the advent of hot weather. This species is probably much more common in Iowa than our few records indicate. Its small size makes it inconspicuous among other grasses.

Chromosome number S=28 (Bowden, 1961).

Widespread in subarctic and temperate North America. Introduced from Europe.



Map 22. Poa chapmaniana



Map 23. Poa annua

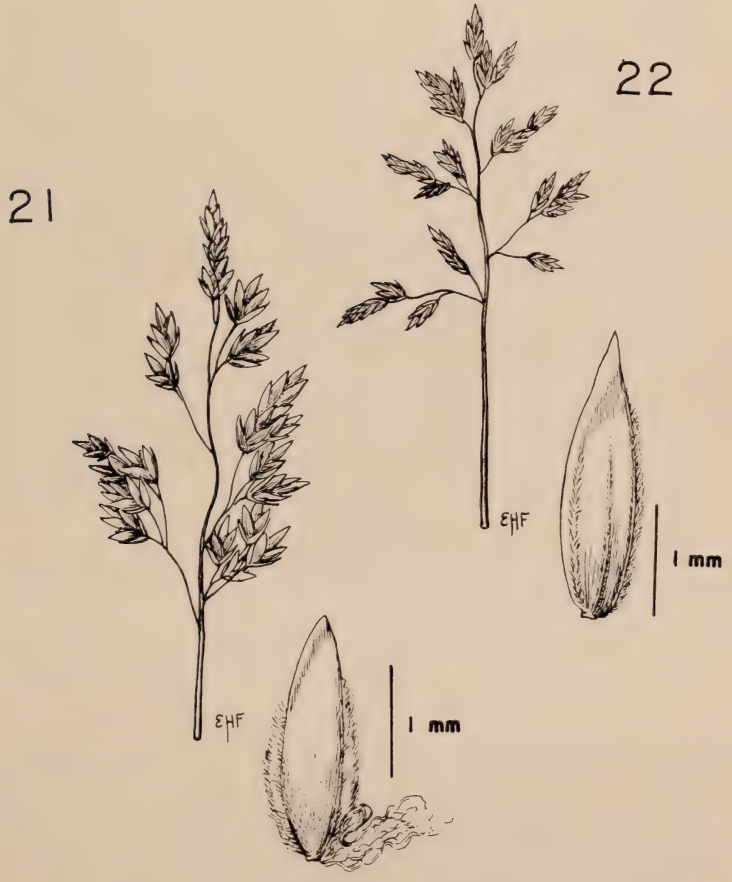


Figure 21. Poa chapmaniana

Figure 22. Poa annua

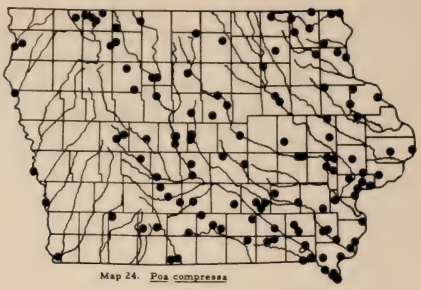


Figure 23. Poa compressa

3. Poa compressa L. Canada bluegrass Fig. 23; Map 24.

Rhizomatous; forming a loose turf. Roadsides, prairies and pastures, dry open woods, loess bluffs. June-July, rarely later. Canada bluegrass is common throughout Iowa, though nowhere as abundant as P. pratensis. Where these two species grow together, P. compressa tends to occupy drier sites and poorer soils. It blooms several weeks later than P. pratensis.

Canada bluegrass furnishes some forage and also appears in lawns. It is probably rarely planted as a forage or lawn grass deliberately, but the seed appears as a contaminant in that of Kentucky bluegrass.

P. compressa, an introduction from Europe, is widespread throughout temperate and subarctic North America.

Chromosome number S=42, 50 (Hartung, 1946) 14, 35, 49, 50, 56 (Keck in Munz, 1959).

4. Poa pratensis L. Kentucky bluegrass Fig. 24; Map 25.
(Incl. P. agassizensis Boivin and Love. Nat. Canad. 87:173-180 (1960).

Perennial; forming a dense, leafy turf. This is certainly the most abundant "wild" grass in Iowa, covering roadsides almost universally. It has wide use as a pasture grass, volunteering abundantly and forming the dominant element in unimproved pastures. It is the most used lawn-grass throughout the northern states. Kentucky bluegrass may be found in almost any noncultivated habitat in Iowa, with the possible exception of dense woods or swamps. It readily invades native prairie when the native vegetation is weakened by grazing, and may eventually become the inheritor of depleted prairie. Poa pratensis begins blooming in Iowa in early May. Most of the flowering occurs in May and June, being two to three weeks earlier than P. compressa.

This species presents a bewildering picture of variability. The plants differ greatly in size, vegetative vigor, leaf size, lemma pubescence, height of culm, and size and density of panicle. Much of this diversity may probably be attributed to the presence of numerous apomictic races, each of which remains constant. Occasional production of sexual seed allows the synthesis of more apomictic strains constantly. Under these circumstances, it does not seem advantageous to designate these variants by name.

Iowa has been one of the principal centers of Kentucky bluegrass seed production in the United States, with the harvesting and processing activity centered around Creston.

Presumably P. pratensis is of Eurasian origin. At the present time it is so abundant and widely distributed in the United States as to make exact determination of its nativity very difficult.

5. Poa arida Vasey. Plains bluegrass Fig. 25; Map 26.

This is a western species, which has been found once in Iowa. The specimen is cited below. Poa arida may possibly be found in similar dry situations in northwestern Iowa.

Lyon County: Prairie among Sioux quartzite exposures, 2 mi. e. of the n.w. corner of Lyon Co. B. Shimek (1897) (IA, ISC).

Chromosome number S=ca76 (Bowden, 1961), 63, 64, 90, 103 (Hartung, 1946).

6. Poa languida Hitch. Fig. 26; Map 27.

Perennial, in small tufts. This species is rare in Iowa. It has been collected a number of times in rocky woods at Wildcat Den, in Muscatine County. May-June.

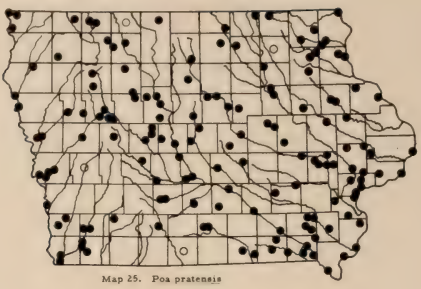
Newfoundland to Pennsylvania and Kentucky, westward to Minnesota and Iowa.

7. Poa sylvestris A. Gray Fig. 27; Map 28.

Perennial; culms in small tufts; rare in rich woodlands in eastern Iowa. Late May and June.

Chromosome number S=28 (Brown, 1939).

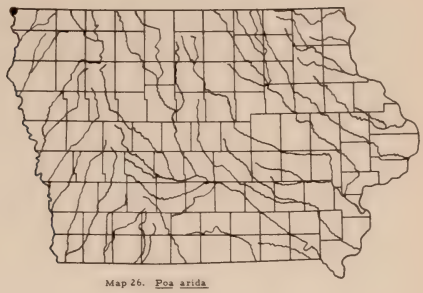
Eastern U.S., from New York to Wisconsin and Nebraska, southward to northern Florida and eastern Texas.



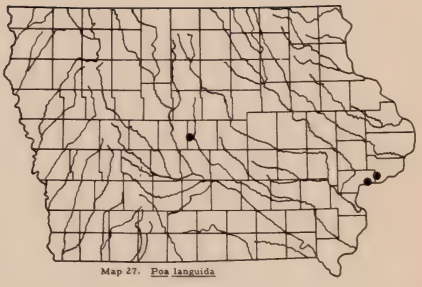
Map 25. Poa pratensis

Figure 24. Poa pratensis

Figure 25. Poa arida

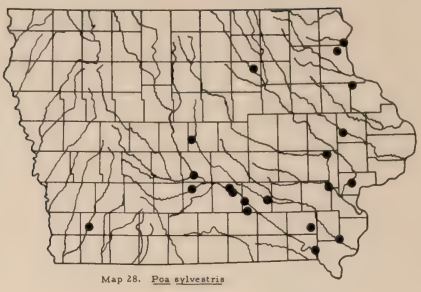


Map 26. Poa arida



Map 27. Poa languida

Figure 26. Poa languida



Map 28. Poa sylvestris

Figure 27. Poa sylvestris

8. Poa wolfii Scribn. Fig. 28; Map 29.

Perennial; in small tufts. Rare; woodlands in eastern and central Iowa. Mid-May-June.

The specimen cited by PBS as this species is another species of Poa.

Central U.S., from Ohio to Minnesota, eastern Nebraska and Missouri.

9. Poa bulbosa L. Fig. 29; Map 30.

Tufted, the culms with bulbous bases. Poa bulbosa reproduces largely by means of the bulblets which are produced by the altered spikelets. It is a European species, and was probably introduced into Iowa in lawn seed from other parts of the country or from Europe. No recent collections have been made. Inflorescences are produced in May.

10. Poa nemoralis L. Fig. 30; Map 31.

Perennial, in tufts. This European species has been cultivated at Iowa State in the past. The specimens reported by PBS are all from such cultivation. The only recent collections are from lawns in Davenport, and may represent introductions in lawn grass seed.

11. Poa palustris L. Fig. 31; Map 32.

Perennial; plants forming loose tufts, often decumbent or rooting at the base. Low, moist prairies, wet shores, marshes, occasionally in woodlands. Late June-August.

Chromosome number S=28 (Hartung, 1946).

Subarctic North America, southward to Virginia, Missouri, the Dakotas and the western mountain states; Eurasia.

12. Poa trivialis L. Fig. 32; Map 33.

Perennial, tufted. This European species is often used in lawn mixtures for shaded sites. While definitely known in Iowa only by several specimens from the Iowa State Campus, this species may well be expected in lawns or as an escape elsewhere in the state.

Chromosome number S=28 (Guinochet, 1943).

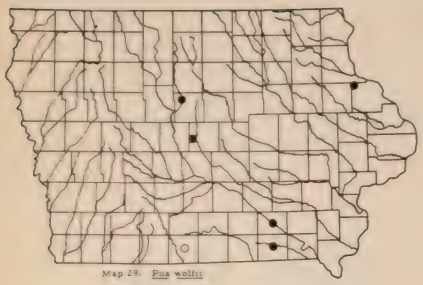
Newfoundland to North Carolina, westward to Minnesota and South Dakota; Pacific Coast States.

13. Poa paludigena Fern. and Wieg. Fig. 33; Map 34.

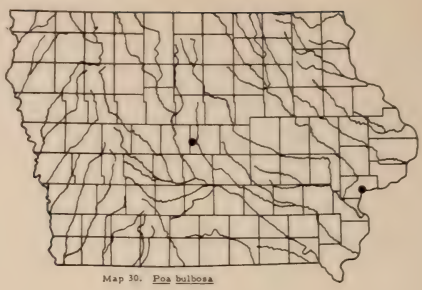
Known in Iowa only by the following specimen:

Allamakee Co.: Postville; balsam fir grove. Pammel, Orr and Wilson, July 8-11, 1904 (ISC).

New York and Pennsylvania, westward to Wisconsin, northeastern Iowa and Illinois.



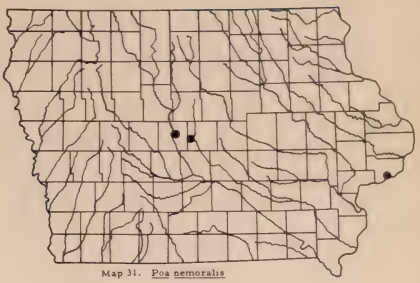
Map 29. Poa wolfii



Map 30. Poa bulbosa

Figure 28. Poa wolfii

Figure 29. Poa bulbosa



Map 31. Poa nemoralis

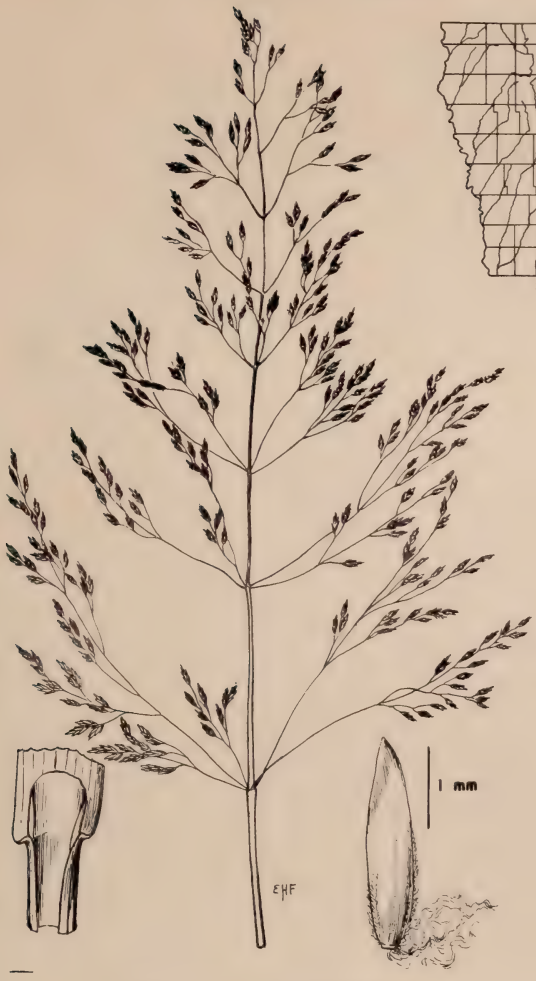
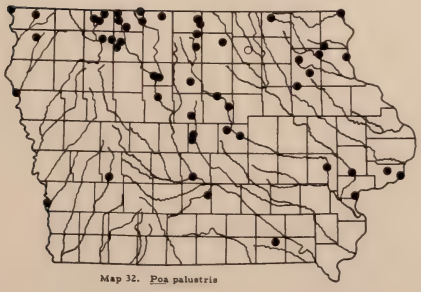


Figure 30. Poa palustris



Map 32. Poa palustris

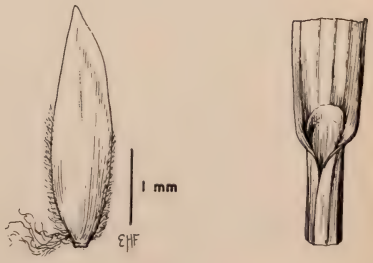
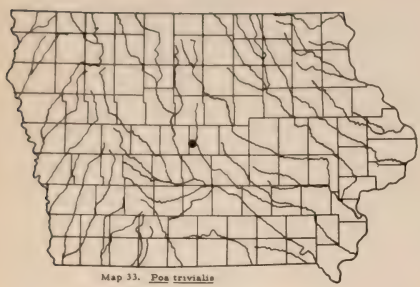
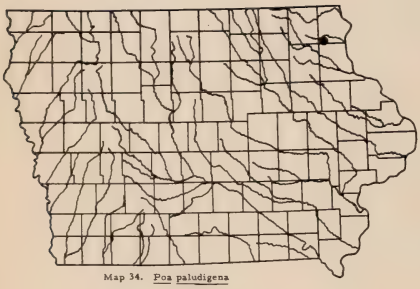


Figure 31. Poa nemoralis



Map 33. Poa trivialis

Figure 32. Poa trivialis



Map 34. Poa paludigena

Figure 33. Poa paludigena

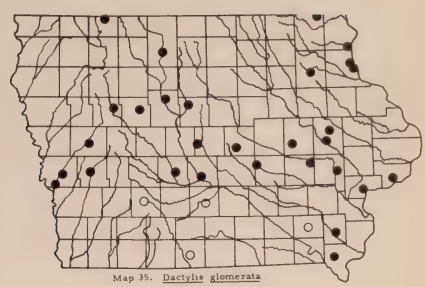

Map 35. Dactylis glomerata

Figure 34. Dactylis glomerata

6. DACTYLIS L.

Tufted perennials, forming large tussocks; culms erect; herbage generally glabrous, pale green; sheaths keeled, with united margins; ligules prominent, membranous, lacerate; leaf blades flat or folded; panicles simple, with a few straight, stiff branches which are naked for most of their length, and bear dense tufts of nearly sessile spikelets at their outer ends. The spikelets are strongly flattened, usually with 3-5 florets. Disarticulation is above the glumes and between the florets.

Dactylis glomerata L. Orchard grass Fig. 34; Map 35.

The spikelets are somewhat variable in pubescence. The majority of the plants have lemmas which are long-ciliate on the keel, but are otherwise glabrous. Two other variants occur among our specimens. In one, the backs of lemmas and glumes are more or less pubescent. In the other, the spikelets are glabrous except for very short cilia on the keels of the lemmas.

Orchard grass is occasionally found in meadows, lawns, and as a stray from cultivation on roadsides and waste ground. The plants are somewhat shade-tolerant. They bloom mostly in May and June, but occasional inflorescences develop as late as September. Orchard grass was introduced from Europe as a forage crop but has become widely naturalized in North America. The earliest herbarium record of orchard grass in Iowa dates back to 1871, but the species is not of particular importance as a crop in the state.

Chromosome number S=28 (Hanson and Hill, 1953B; Bowden, 1960A).

TRIBE 2. DIARRHENEAE

7. DIARRHENA Beauv.

Perennial; freely rhizomatous; leaves mostly near the bases of the culms; panicles slender, with few short ascending branches; spikelets few-flowered, disarticulating above the glumes and between the florets; lemmas coriaceous; grains large, bottle-shaped, the "neck" protruding from the floret at maturity. A single species with two geographic varieties is found in America.

Diarrhena americana Beauv., var. ovata Gleason. Fig. 35; Map 36.

Occasional in rich, moist woodlands, on slopes and flood plains; southern and western counties. July-October.

This is one of the strangest of our grasses. The peculiar grains distort the original shape of the spikelets greatly as they mature. Each leathery grain contains a seed which is free from the ovary wall except at the base. Such a structure is technically an achene. Achenes are of rare occurrence in the Gramineae, most of the recorded examples being found in the bamboos or in the genus Sporobolus.

Chromosome number S=60 (Anderson, 1958, unpubl.).

Var. ovata, the more westerly phase of the species, ranges from Michigan, Ohio and Kentucky to southeastern South Dakota and central Texas.

TRIBE 3. AVENEAE

8. KOELERIA Pers.

Perennial, tufted; panicles dense and cylindrical, sometimes somewhat lobed; spikelets disarticulating above the glumes and between florets; glumes nearly as long as the spikelet, the second slightly longer and broader than the first; florets usually two, the rachilla prolonged beyond the last floret as a slender bristle; lemmas tapering to a point or very short awn.

Koeleria cristata (L.) Pers. Junegrass Fig. 36; Map 37.

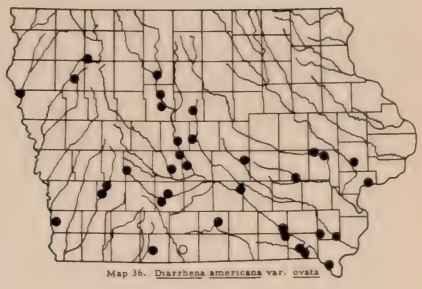
Widespread and common; prairies, loess bluffs, sand plains. Mid-May-August.

Most descriptions of this species state that the spikelets have 2 to 5 florets. Iowa specimens are nearly all 2-flowered, with a very few possessing a third abortive or functional floret.

Chromosome numbers S=28 (Stebbins and Love, 1941); S=14+1, 14+2 (Tateoka, 1954), S=70 (Avdulov, 1931); S=14 (Bowden, 1960B).

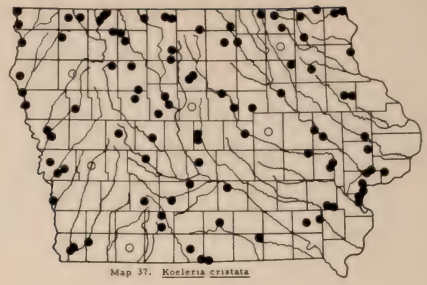
United States and southern Canada, southward to Mexico; absent from the southeastern states; Eurasia.

Shinners (1956) has discussed the nomenclature of Koeleria and takes up the name K. gracilis Pers. for our species. Neither the Linnean description of Aira cristata nor the microfiches of the Linnean Herbarium gives a clear indication of the identity of Linnaeus' species, which is presumably the basis of K. cristata.



Map 36. Diarrhena americana var. ovata

Figure 35. Diarrhena americana



Map 37. Koeleria cristata

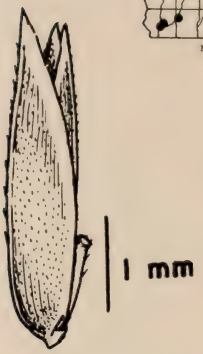


Figure 36. Koeleria cristata

9. SPHENOPHOLIS Scribn.

Tufted annuals or perennials; panicles narrowly cylindrical to spike-like; spikelets disarticulating below the glumes, strongly laterally compressed; first glume linear; second glume much broader, obovate, acute or truncate at the apex; rachilla prolonged beyond the second floret, rarely bearing a third floret. The plants are widespread, but occur too sparingly to be of much forage value in our area.

Erdman, K.S. 1965. Taxonomy of the genus Sphenopholis. Iowa State Jour. Sci. 39:259-336.

Key to Species

1. Second glume very broadly rounded or truncate at the apex, the length 2-3 times the folded width; lower rachilla joint 0.5-0.7 mm long; panicle usually densely cylindrical . . . . . 1A. S. obtusata, var. obtusata

1. Second glume acute, the length 3-6 times the folded width; lower rachilla joint 0.8-1.0 mm long; panicle rather loose . . . . . 1B. S. obtusata, var. major

1A. Sphenopholis obtusata (Michx.) Scribn. var. obtusata. Wedgegrass Fig. 37; Map 38.

Occasional on moist or dry prairies, loess bluffs, open woods; throughout Iowa. The spikelets sometimes develop purple coloration. June-July.

Chromosome number S=14 (Brown, 1950; Erdman, 1965).

Maine to British Columbia, southward throughout the United States; Mexico; Hispaniola; Bermuda.

Recent studies of this genus by Erdman have shown that S. obtusata and S. intermedia, which are maintained as separate species in most manuals, cannot be satisfactorily distinguished on morphological or cytological grounds.

1B. Sphenopholis obtusata var. major (Torr.) Erdman. Fig. 38; Map 39.

Occasional; low moist ground, shores, ditches, open woods. Late May-July.

Var. major has the same general distribution as var. obtusata, but is rare or absent in the southeastern and southwestern states.

Chromosome number S=14 (Bowden, 1960B; Erdman, 1965).

10. AVENA L.

Annuals; tufted; inflorescence an open panicle; spikelets large, the glumes enveloping the two or three florets; awn arising from the back of the lemma; disarticulation above the glumes and usually between the florets.

Key to Species

1. Awns well developd, twisted, bent and exserted from the spikelet; lemmas hairy on the back; wild plants. . . . 1. A. fatua

1. Awns short, weak, straight, or absent; lemmas glabrous except for a tuft of hairs on the callus. . . . . 2. A. sativa

1. Avena fatua L. Wild oats Fig. 39; Map 40.

The wild oat resembles the cultivated species, to which it is closely related. The florets, however, disarticulate by means of a rounded "sucker-mouth" area near the base on the inner or palea side of the floret. This species is rare in Iowa, and there have been only two recent collections. Wild oats may be confused with fatuoids of cultivated oats, which are described below. Early summer. Introduced from the Old World. Chromosome number S=42.

Northeastern states, westward to the Pacific Coast; common in the Pacific Coast States.

2. Avena sativa L. Cultivated oats

Oats is the most important small grain grown in Iowa. In cultivated oats, the florets disarticulate by fracture at the base of the lemmas. The lemmas are glabrous except for some slight hairiness on the callus. In agronomic strains of oats, variants called "fatuoids" may occur. These resemble A. fatua in having strong awns and the "sucker-mouth" type of disarticulation. The lemmas, however, are glabrous, and in their other characteristics the fatuoids resemble the particular variety of oats from which they are derived. In cultivated oats and the fatuoids, the scutellum is sunken, with only the narrow embryo axis visible. Huskins (1946) has discussed fatuoids at length. Coffman (1961) has published a comprehensive discussion of the culture, breeding, and genetics of oats. Chromosome number S=42. Introduced from the Old World.

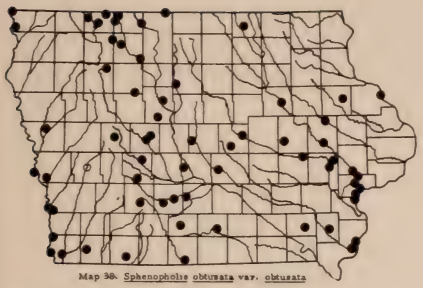
11. ARRHENATHERUM Beauv.

Plants perennial, tufted; panicles narrow; spikelets 2-flowered, disarticulating above the glumes, both florets falling together, the rachilla prolonged beyond the upper floret as a slender bristle. Lower floret staminate, bearing a geniculate exserted awn attached below the middle of the lemma; upper floret perfect, bearing a short, straight awn near the tip.

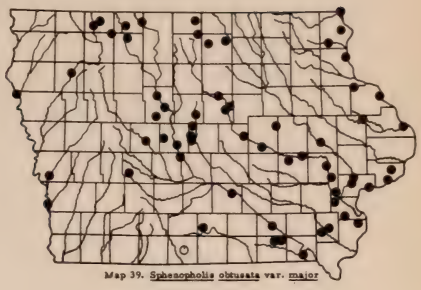
Arrhenatherum elatius (L.) Presl. Tall oatgrass Fig. 40; Map 41.

Tall oatgrass is a forage grass used to some extent in the northern U.S. It has been found several times growing in the wild in Iowa, presumably as an escape from cultivation. Occasional plants have both awns of the spikelet well-developed and geniculate. These specimens have been named var. biaristatum Peterm. One such plant was found growing at Clarinda, probably from seed scattered during processing. Some plants have a series of internodes at the base of the culms swollen into small tubers. June-July. Introduced from Europe.

Chromosome number S=28 (Delay, 1951).



Map 38. Sphenopholis obtusata var. obtusata



Map 39. Sphenopholis obtusata var. major

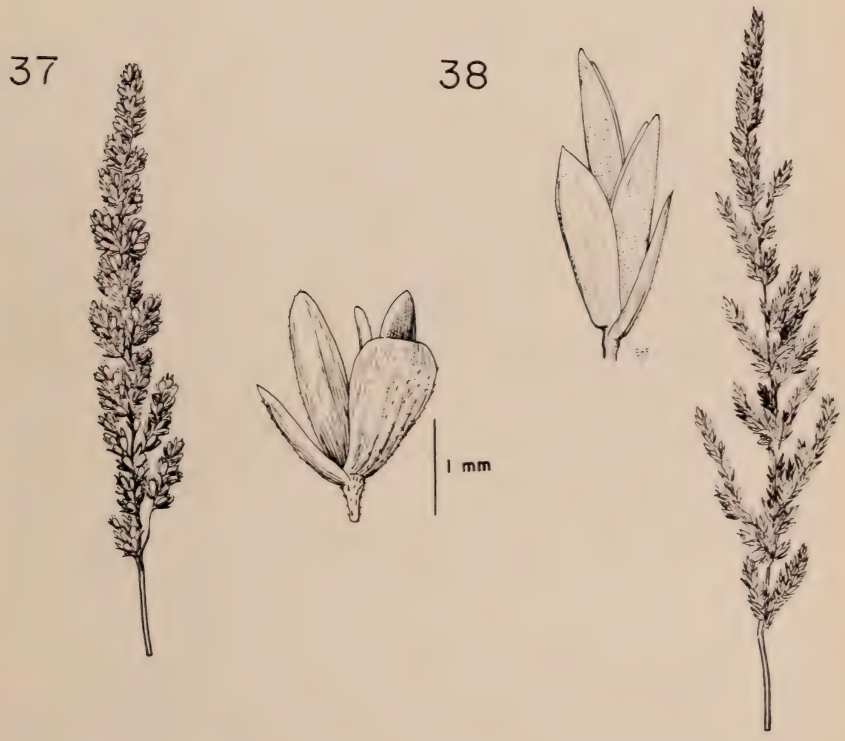
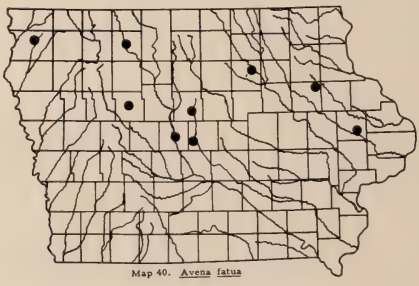


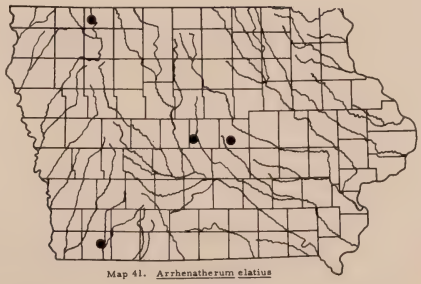
Figure 37. Sphenopholis obtusata var. obtusata

Figure 38. Sphenopholis obtusata var. major



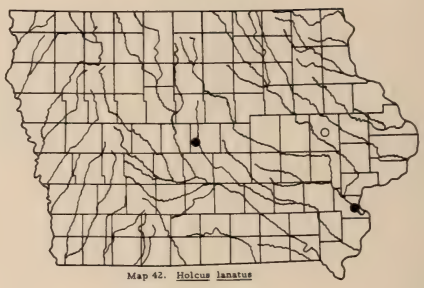
Map 40. Avena fatua

Figure 39. Avena fatua



Map 41. Arrhenatherum elatius

Figure 40. Arrhenatherum elatius



Map 42. Holcus lanatus

Figure 41. Holcus lanatus

12. HOLCUS L.

Perennial; panicles crowded; spikelets disarticulating below the glumes; glumes subequal, longer than the florets, pubescent; florets 2, the lower awnless and perfect, the second staminate and bearing a short hooked awn. Herbage velvety.

Holcus lanatus L. Velvet grass Fig. 41; Map 42.

Velvet grass is an introduction from Europe and has rarely been cultivated in the United States. It has been known to cause cyanide poisoning in livestock. Our records of this species are all based upon collections made prior to 1920, and the plant probably is no longer found in the state. Chromosome number S=14 (Avdulov, 1931).

Maine to Georgia, westward to Iowa and Louisiana; Kansas, Colorado, Rocky Mountain and Pacific Coast States.

TRIBE 4. AGROSTIDEAE

13. AGROSTIS L. Bentgrass

Plants perennial, tufted; stoloniferous, or rhizomatous; inflorescence an open or contracted panicle; spikelets small, disarticulating above the glumes, the glumes exceeding the floret; floret membranaceous, usually awnless, glabrous or slightly pubescent on the callus; rachilla not prolonged beyond the palea.

Key to Species

1. Palea at least half as long as the lemma
   2. Plants erect, rhizomatous; panicle branches spreading 1. A. alba
   2. Plants trailing, producing extensive stolons; panicle branches appressed to the rachis, the panicle narrow and contracted . . . . . 2. A. palustris
1. Palea very short or absent
   3. Panicle very diffuse, the principal lower branches very elongated, branching only above the middle or toward the tip
      4. Spikelets 1.4-2.1 mm long, loosely clustered and usually short-pedicellate or subsessile near the branch tips; plants usually blooming in late May and early June in Iowa. . . . . 3. A. hiemalis
      4. Spikelets 2.0 mm or more long; pedicels frequently as long as the more scattered spikelets; plants blooming in late June and July in Iowa. . . . . 4. A. scabra
   3. Panicle open but not diffuse, the branches forking below the middle. . . . . 5. A. perennans

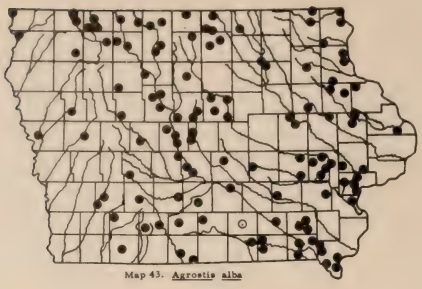
1. Agrostis alba L. Redtop Fig. 42; Map 43.

Perennial, rhizomatous. Common on open ground, particularly in ditches or around water; rarely in open woods. June-July, rarely to September.

The plants are highly variable as to density of the panicle and as to the growth habit of the plant. While several species in this general group are recognized in current manuals, our herbarium specimens cannot be satisfactorily segregated. Since a number of species of Agrostis are used for lawns, it is also possible that some of these may occasionally be found in Iowa.

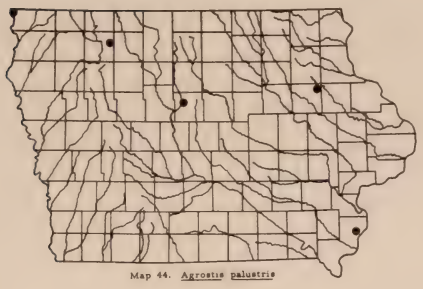
Chromosome number S=28 (Nielsen and Humphrey, 1937); S=42 (Bowden, 1960). Temperate North America; introduced from Eurasia.

Redtop is a forage grass of European origin. It grows well on poor soils and in wet places. It is probably not cultivated in Iowa, but is very widespread in the state. Redtop is frequently added to lawn seed mixtures but the plants do not persist long in lawns under our climatic conditions.



Map 43. Agrostis alba

Figure 42. Agrostis alba



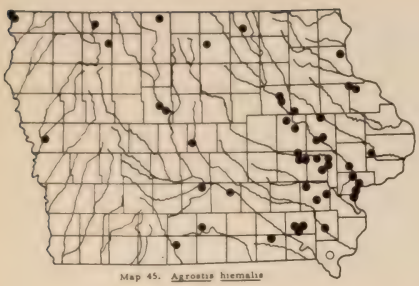
Map 44. Agrostis palustris

Figure 43. Agrostis palustris

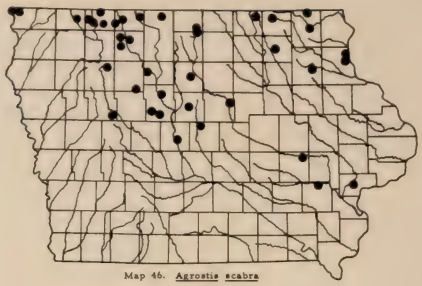
2. Agrostis palustris Huds. Creeping Bent Fig. 43; Map 44.

Low stoloniferous perennial. Cultivated for golf greens and occasionally escaped in wet sites. The plants are readily recognizable in nature, but herbarium specimens may not always be determinable. This species is closely related to the A. alba complex, differing chiefly in the stoloniferous habit. June-August.

Chromosome numbers S=30 (Bowden, 1960B), 28 (Church, 1936), 42 (Shibata, 1957). Introduced from Eurasia.



Map 45. Agrostis hiemalis

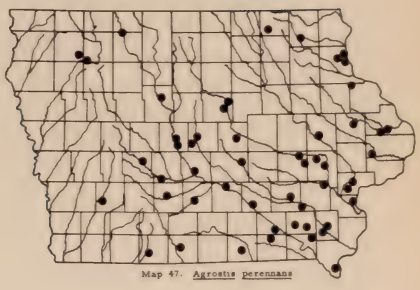


Map 46. Agrostis scabra

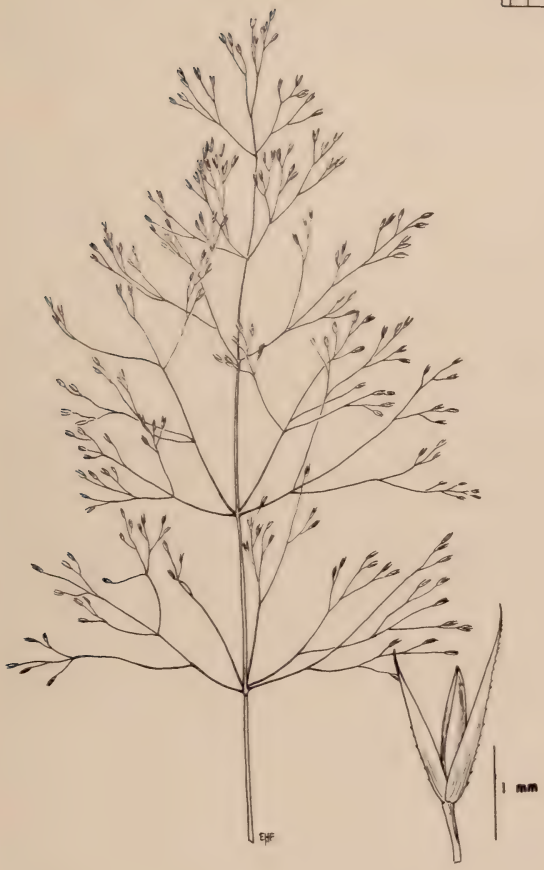
Figure 44. Agrostis hiemalis (A); A. scabra (B)

3. Agrostis hiemalis (Walt.) B.S.P. Ticklegrass Fig. 44, A; Map 45.
Tufted perennial. Sandy or rocky prairies, open dry woods, sand dunes, loess bluffs; probably throughout the state but rare or overlooked in the southwestern counties. This species blooms mostly in late May and early June, rarely to early July. A. scabra, which may accompany it, blooms later. Chromosome number S=28 (Gould, 1958).
Eastern and central U.S., from Massachusetts to Iowa and Kansas and southward.

4. Agrostis scabra Willd. Ticklegrass Fig. 44, B; Map 46.
Tufted perennial. prairies; northern half of the state, extending as far south as The Ledges. Late June-August, rarely blooming in early June. Chromosome number S=42 (Bowden, 1960B).
Labrador to Alaska and southward throughout most of the U.S.



Map 47. Agrostis perennans



5. Agrostis perennans (Walt.) Tuck. Fig. 45; Map 47.

Weak delicate perennial, in small tufts in upland or lowland woods. Occasional throughout most of the state except the southwest one-third. August-October.

Chromosome number S=42 (Bowden, 1960B).

Quebec to Minnesota, southward to Florida and Texas.

14. CALAMAGROSTIS Adans. Bluejoint

Rhizomatous perennials; inflorescence an open or contracted panicle; glumes mostly longer than the floret; lemmas with a dorsal awn; rachilla prolonged behind the palea as a thin hairy bristle; callus of the lemma bearing numerous slender ascending trichomes, surrounding and partially concealing the floret. Ours are marsh or wet-ground plants.

1. Inflorescence an open pyramidal panicle; lower branches not spikelet-bearing near their bases. . . . . 1. C. canadensis

1. Inflorescence a dense cylindrical panicle, the short erect branches bearing densely-clustered spikelets to their bases 2. C. inexpansa

Literature

Stebbins, G. Ledyard. 1930. A revision of some North American species of Calamagrostis. Rhodora 32:35-37.

1. Calamagrostis canadensis (Michx.) Beauv. Bluejoint Fig. 46; Map 48.

Rhizomatous perennial; common throughout the state. Wet spots in prairie, ditches, peat bogs, marshes. Mid-June—August.

This species varies considerably in spikelet size, glume shape, and panicle density. A number of varieties have been proposed by Stebbins.

Chromosome numbers S=42, 45, 48, 49, 51, 56, 62, 66 (Nygren, 1954). Some apomixis occurs.

In some northern areas bluejoint is cut for marsh hay. The plants are apparently too scattered to be of much economic value in Iowa.

Greenland to Alaska, southward to New Jersey, North Carolina, Kentucky, Kansas, New Mexico, Arizona and California.

2. Calamagrostis inexpansa A. Gray. Fig. 47; Map 49.

Rhizomatous perennials; occasional in prairie marshes, peat bogs, fens. Mostly confined to the Des Moines Glacial Lobe area in north-central and northwestern Iowa. Mid-June—August.

Chromosome numbers S=28, 56, 58, 84-105 (Nygren, 1954); 70 (Bowden, 1960B). Some apomixis occurs.

Greenland to Alaska, southward to Virginia, Missouri, New Mexico, Arizona and California.

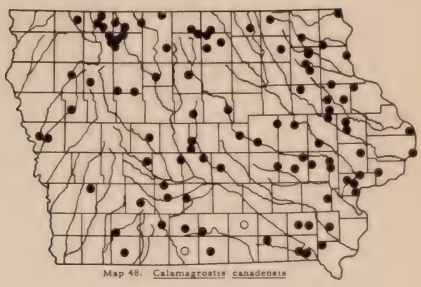
15. CINNA L.

Woodland perennials, tufted, the basal internodes of the culms bulbous; panicles drooping, densely-flowered; spikelets very flat, disarticulating below the glumes from a minute cupule; first glume slightly shorter than the floret, the second slightly longer; lemma short-awned from slightly below the tip; palea apparently one-keeled.

Cinna arundinacea L. Woodreed. Fig. 48; Map 50.

Common in alluvial woods; widely distributed in Iowa. Late June—early October. Chromosome number S=28 (Bowden, 1960B).

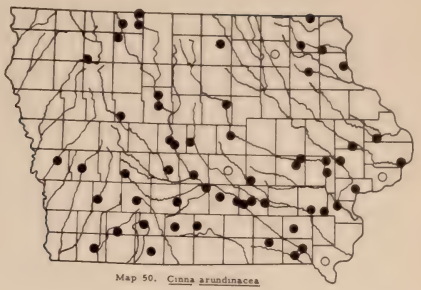
Maine to Georgia, westward to South Dakota and eastern Texas.



Map 48. Calamagrostis canadensis

Figure 46. Calamagrostis canadensis

Figure 47. Calamagrostis inexpansa



Map 50. Cinna arundinacea

Figure 48. Cinna arundinacea

16. ALOPECURUS L.

Plants annual or perennial; tufted; inflorescence a dense, cylindrical panicle; spikelets laterally flattened, one-flowered, disarticulating below the equal, partially joined glumes; lemma awned from the back; palea lacking.

Key to Species

1. Spikelets 2-3 mm long; panicles usually 3-5 mm thick; awns included or exserted.

   2. Awn included or barely exserted, straight . . . 1. A. aequalis

   2. Awn exserted about 2 mm, bent . . . . . 2. A. carolinianus

1. Spikelets 5 mm or more long; panicles 7-10 mm thick; awns exserted, bent . . . . . 3. A. pratensis

1. Alopecurus aequalis Sobol. Fig. 49; Map 51.
Perennial; muddy shores of lakes and ponds, marshes, often growing in shallow water. Late May-September. Fairly common in northern Iowa. Chromosome number S=14 (Ono and Tateoka, 1953).
Circumpolar in Arctic regions, southward to Pennsylvania, Kansas, New Mexico and California.

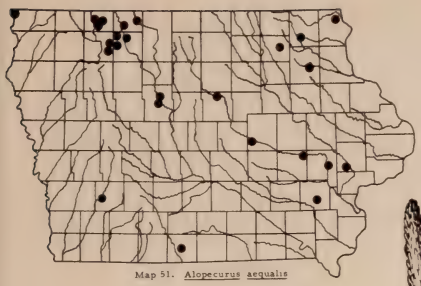
2. Alopecurus carolinianus Walt. Fig. 50; Map 52.
Annual; roadsides and ditches, edges of ponds, moist cultivated fields and meadows. May-June.
Widespread in the U.S.

3. Alopecurus pratensis L. Meadow foxtail.
This species was once cultivated at Ames for experimental purposes. The only other record from Iowa is from the yard of a seed-processing plant at Clarinda. Probably not established in the state.
Introduced from Eurasia.

17. PHLEUM L.

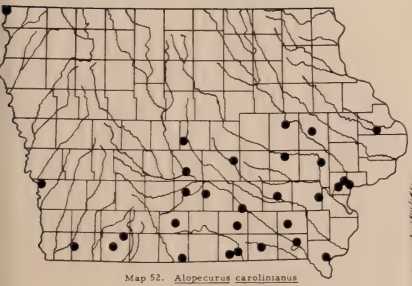
Perennial, tufted; basal internodes of stem frequently swollen into small tubers; inflorescence a dense cylindrical terminal panicle; spikelets very flat, the equal glumes compressed and keeled, usually ciliate, truncate and with an excurrent midrib; disarticulation above the glumes; Floret much shorter than the glumes, smooth, awnless. Weathered panicles eventually disarticulate below the glumes, but threshed seed consists of caryopses or florets.

Phleum pratense L. Timothy. Fig. 51; Map 53.
Extensively cultivated as a forage grass and widely naturalized; open ground. Introduced from Eurasia. Chromosome numbers S=42; 21, 28-91 (Levan, 1948).



Map 51. Alopecurus aequalis

49



Map 52. Alopecurus carolinianus

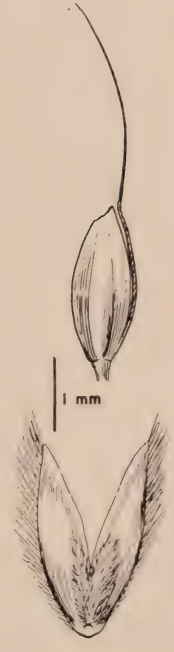


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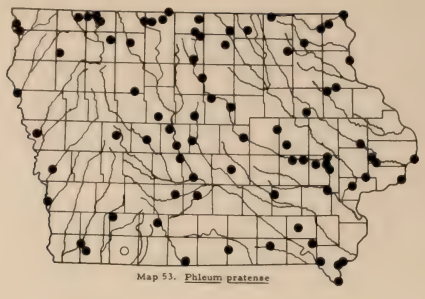
Figure 49. Alopecurus aequalis
Figure 50. Alopecurus carolinianus



Map 53. Phleum pratense

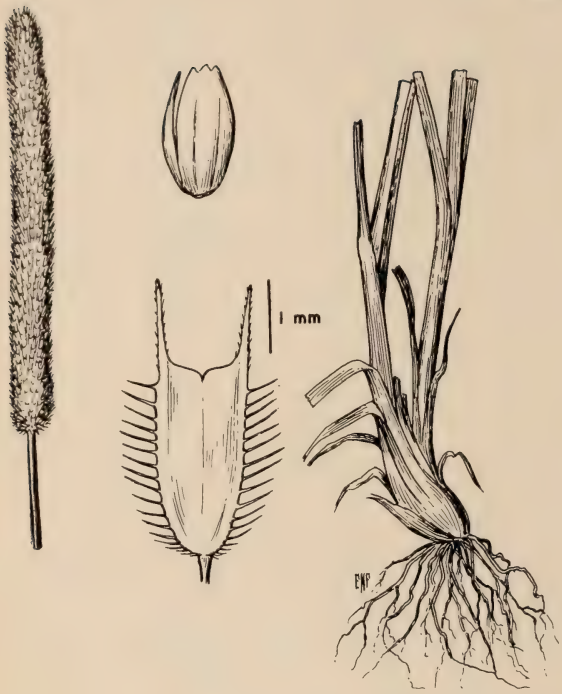


Figure 51. Phleum pratense

17A. MILIUM L.

Milium effusum L.

This northern species has been recently collected in northern Allamakee County, near the Minnesota border. It is to be looked for in cool, moist, shaded areas in this part of the state. The specimen is cited below:

Steep moist bluff bordering Bear Creek at Quandahl, Allamakee Co., Iowa. July 13, 1959, T.G. Hartley 7411 (IA, ISC).

Figure 52. Beckmannia syzigachne

18. BECKMANNIA Host.

Plants annual, tufted, erect; inflorescences dense, of numerous erect spikes; spikelets in two rows along the lower side of the rachis; disarticulation below the glumes; spikelets orbicular, flattened, the glumes equal; floret one, narrowly ovate; rachilla prolonged behind the palea as a minute papilla. Occasional spikelets may have two florets.

Beckmannia syzigachne (Steud.) Fernald. Sloughgrass. Fig. 52; Map 54.

Wet ground or shallow water, margins of ponds, lakes, and streams. Mid-June-August. This species is found in the lake region of northwestern Iowa.

Chromosome number S=14 (Bowden, 1960A, Tateoka, 1954).

Alaska to California, eastward to Manitoba, New Mexico, and New York.

TRIBE 5. TRITICEAE

19. AGROPYRON Gaertn. Wheatgrass

Plants annual or perennial, tufted or rhizomatous; inflorescence a solitary terminal balanced spike, with a single spikelet placed flatwise at each node (rarely 2 spikelets at a few nodes); spikelets with 3-several florets; glumes about equal, shorter than or about equalling the florets; spikelets disarticulating above the glumes and between the florets, or rarely the entire spikelet falling from the rachis.

Key to Species

1. Spikelets very crowded, standing away from the rachis at an angle of 45 degrees or more

   2. Glumes straight, aligned with the midribs of the lemmas . . . . . 1. A. desertorum

   2. Glumes bent and distorted near the base, the tip directed to one side . . . . . 2. A. cristatum

1. Spikelets not crowded, appressed to the rachis of the spike

   3. Glumes and lemmas tapering to an acute, acuminate, or awned apex

      4. Plants rhizomatous; spikelets ovate in outline, considerably wider than the rachis, tending to disarticulate entirely from the naked rachis at maturity

         5. Leaves bluish-glaucous, often involute, the upper surface coarsely furrowed with 7-14 ridges across the width . . . . . 3. A. smithii

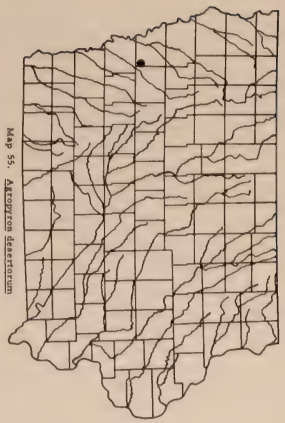
         5. Leaves usually green, thin and flat, the upper surface with 25-40 fine nerves across the surface . 4. A. repens

      4. Plants tufted, without rhizomes; spikelets slender, scarcely wider than the rachis (except in awned forms); florets dropping from the persistent glumes . . 5. A. trachycaulum

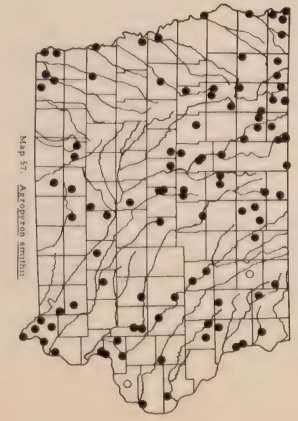
   3. Glumes and lemmas very blunt.

      6. Leaves involute, the upper surfaces coarsely grooved, with 6-8 ridges across the width; glumes 6-10 mm long; plants tufted. . . . . 6. A. elongatum

      6. Leaves flat, the upper surfaces finely nerved, with 20-28 nerves across the width; glumes 4-8 mm long; plants rhizomatous. . . . . 7. A. intermedium



Map 55. Agropyron desertorum



Map 57. Agropyron smithii

53

Figure 53. Agropyron desertorum

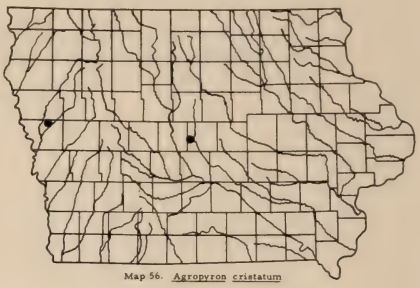
54

Figure 54. Agropyron smithii

1. Agropyron desertorum (Fisch.) Schult. Crested wheatgrass. Fig. 53; Map 55.

Found wild in Iowa only in Monona and Story Counties, where it occurred as a probable adventive from the northern Great Plains. It is widely cultivated as a forage grass in that area. Introduced from Eurasia.

2. Agropyron cristatum (L.) Gaertn. Fairway crested wheatgrass. Map 56. Planted experimentally in Iowa for erosion control. Introduced from Eurasia.



Map 56. Agropyron cristatum

3. Agropyron smithii Rydb. Western wheatgrass. Fig. 54; Map 57.

Rhizomatous perennial; widespread in Iowa, primarily on dry soils; railroad embankments, road shoulders, loess hills, prairies. June-July, rarely later.

A. smithii, which is primarily a western species, is more selective of sites than the similar quackgrass. While possessing rhizomes, it does not become an aggressive weed as quack does. The plants have a strong bluish-glaucous coloration which makes them recognizable from a distance. Occasional spikes may bear two spikelets at some of the lower nodes. Scattered individuals may have pubescent spikelets. They have been designated as forma molle (Scribn. and Smith) Gillett and Senn Can. J. Bot. 38:750 (1960).

Chromosome number S=28, 56 (Hartung, 1946); 56 (Gillett and Senn, 1960).

New York and Tennessee westward to British Columbia and California; rare or adventive in the eastern states.

4. Agropyron repens (L.) Beauv. Quackgrass. Fig. 55; Map 58.

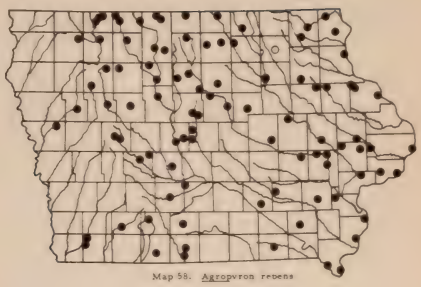
Strongly rhizomatous perennial; widespread and common in Iowa, but more frequent in the northern portion. Roadsides, railroad embankments, fields, ditches, sometimes invading native grassland. June-July, rarely later.

Quackgrass is the most common and widespread perennial grass weed in the northern United States. It has long been a serious agricultural pest in Iowa. Our earliest specimens date back to 1871, when the Iowa State Herbarium was founded. By the early 1890's it had become frequent enough to cause serious concern among farmers.

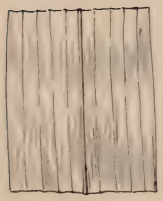
Awned and awnless forms are known and occur intermixed. For an account of these, the reader is referred to Fernald (1933B).

Chromosome number S=42 (Hunziker, 1954, Cauderon, 1958).

Newfoundland to North Carolina, westward to southern Alaska and California. Introduced from Europe.



Map 58. Agropyron repens



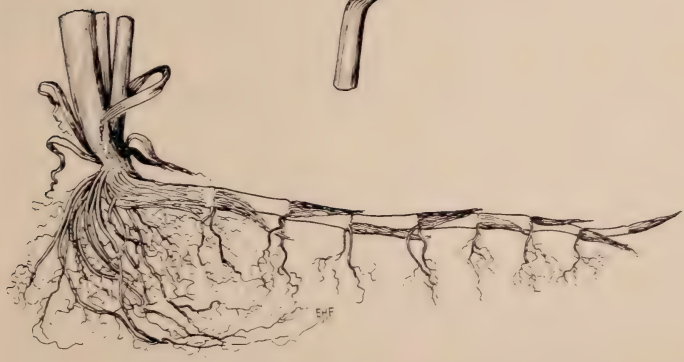


Figure 55. Agropyron repens

Agropyron repens (L.) Beauv. X A. trachycaulum (Link) Malte

These plants are found rarely in Iowa. The inflorescence and spikelets resemble those of awnless forms of A. trachycaulum, but the plants produce rhizomes. They are apparently recent hybrids of A. trachycaulum and A. repens. The latter is the only rhizomatous species common in the area. The plants do not show any of the characteristics of A. smithii, the only other rhizomatous species in Iowa. Our specimens, listed below, have low seed set (0, 11, 33 and 66% in separate specimens) and all have empty, collapsed pollen grains. Hubbard (1954) reports similar male-sterile hybrids of A. repens and other species in Great Britain. He states that A. repens is self-sterile. Many of our weed infestations of A. repens have probably originated from single seeds, followed by extensive vegetative spread. The absence of other genetic strains of A. repens would make crossing with other species quite probable. Since these hybrids listed below were detected by the presence of rhizomes, other specimens lacking rhizomes were probably undetected. This cross may have occurred much more frequently than we are able to tell from herbarium records.

Cerro Gordo Co.: Mason City. Aug. 12, 1922. L.H. Pammel; Clay County: Dickens. Sept. 10, 1934. Jess Fults 2908; Dickinson Co.: Without locality. R.I. Cratty Aug. 1921. ISU 97682; Howard Co.: Hayden Prairie, R. 13W, T 100 N., Sec. 33, July 9, 1952, R.L. McDill 295; Kossuth Co.: S.E. $\frac{1}{4}$ Sec.31, Wesley Twp. July 21, 1951. Richard W. Pohl 7136.

5. Agropyron trachycaulum (Link) Malte. Slender wheatgrass. Fig. 56; Map 59. (Including A. subsecundum (Link) Hitch.)

Tufted perennial; occasional on prairies in the northern half of the state, and apparently most common in the northern tier of counties. Mid-June - mid-August.

This species occurs in both awnless and awned forms, which are strikingly different in appearance. However, they have the same geographic range in the United States and their Iowa distribution is closely parallel. In some sites, both forms occur together. A number of named varieties are given by Fernald (1933B).

Chromosome number S=28 (Boyle and Holmgren, 1955, Hartung, 1946).

Labrador to Alaska and southward to West Virginia, Kansas, New Mexico and California.

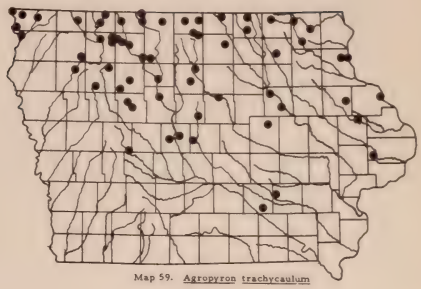
This species is one parent of X Agrohordeum macounii, which is often found growing with it in the northern counties.

6. Agropyron elongatum (Host) Beav. Tall wheatgrass. Map 60.

This species was introduced from Turkey and has been planted experimentally in Story, Polk, and Monona Counties. It is a coarse, rush-like, tufted perennial. It may escape from artificial plantings.

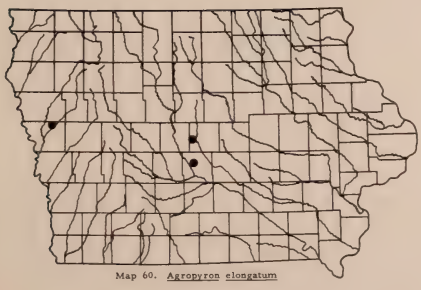
7. Agropyron intermedium (Host) Beauv. Intermediate wheatgrass. Map 61.

This species has been planted experimentally in Iowa. It is a perennial spreading by vigorous rhizomes. Introduced from southern Europe.

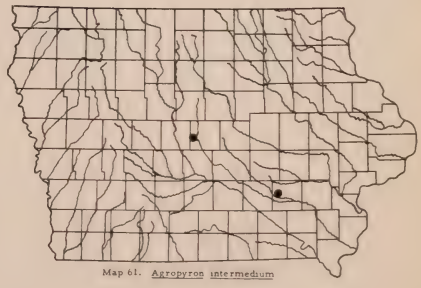


Map 59. Agropyron trachycaulum

Figure 56. Agropyron trachycaulum



Map 60. Agropyron elongatum



Map 61. Agropyron intermedium

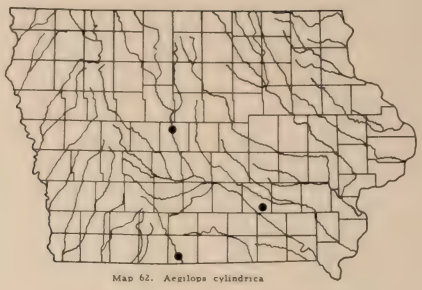

Map 62. Aegilops cylindrica

Figure 57. Aegilops cylindrica

21. AEGILOPS L.

Annuals; tufted; culms unbranched, bearing cylindrical terminal spikes; rachis disarticulating at the base of each internode, bearing the single attached spikelet; internodes thin at the base, thickened at the apex; spikelets several-flowered, fitting closely into the hollow of the rachis; glumes coriaceous, bearing an awn and a lateral tooth; lemmas thinner, similar to the glumes but awnless or short-awned. The upper spikelets of the spike bear much longer awns than the lower.

The genus is of great evolutionary interest because of its close relationship to wheat. One species of Aegilops is regarded as ancestral to the bread wheats. The species growing in this country are grainfield weeds.

Aegilops cylindrica Host. Goatgrass Fig. 57; Map 62.

Goatgrass has been collected in Iowa several times on roadsides and railroad rights-of-way. It is frequent in the southern Great Plains and our specimens are probably waifs brought in from that area via the railroads. Boone, Mahaska, and Decatur Counties. Introduced from the Old World. Chromosome number S=28 (Kihara, 1954).

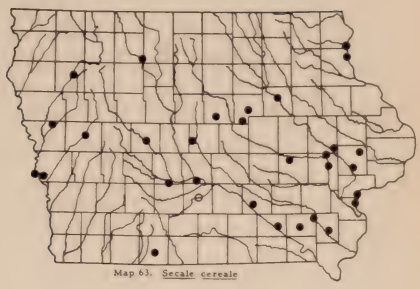

Map 63. Secale cereale

Figure 58. Secale cereale

22. SECALE L.

Plants annual, tufted, culms unbranched, bearing single terminal balanced spikes; spikelets single at each node of the rachis, placed flatwise against it; disarticulation above the glumes; glumes shorter than the florets; florets two, strongly keeled, pectinate-ciliate on the keel with short, stiff hairs; rachilla prolonged beyond the uppermost floret; grain falling free from the floret.

Secale cereale L. Rye Fig. 58; Map 63

Rye is grown to a very limited extent for forage and grain in Iowa. It is often used to stabilize newly graded road shoulders. The records which we have probably represent waifs growing from scattered seed, for rye does not persist after cultivation ceases. Introduced from Europe.

Chromosome number S=28 (Müntzing, 1937A).

23. ELYMUS L. Wildrye

Plants perennial, tufted; inflorescence a terminal balanced spike; rachis continuous, with usually two spikelets at each node (3, 4, or more in vigorous E. canadensis); spikelets with 2-several florets, usually disarticulating above the glumes and between the florets; glumes narrow, not folded; rachilla distorted so that the back of the first lemma is visible between the glumes.

The species of this genus (with the exception of E. villosus) are extremely variable and apparently hybridize freely. Many aberrant specimens do not fit the standard keys and descriptions and can only be placed approximately. Some of these exhibit pollen sterility and are probably of hybrid origin. The so-called E. macounii is not an Elymus and will be found listed under X Agrohordeum.

Literature

Brown, Walter V. and G. A. Pratt. 1960. Hybridization and introgression in the grass genus Elymus. Amer. J. Bot. 47:669-676.

Church, G. L. 1954. Interspecific hybridization in eastern Elymus. Rhodora 56:185-197.

_____. 1958. Artificial hybrids of Elymus virginicus with E. canadensis, interruptus, riparius, and wiegandii. Amer. J. Bot. 45:410-417.

Fernald, M. L. 1933. Types of some American species of Elymus. Rhodora 35:187-198.

Pohl, Richard W. 1959. Morphology and cytology of some hybrids between Elymus canadensis and E. virginicus. Proc. Iowa Acad. Sci. 66:155-159.

Key to Species

1. Awns strongly curved when mature and dry; spikes arching or drooping

   2. Glumes flattened above the base, usually 20-35 mm long; inflorescences dense, curved but not hanging vertical; leaf blades firm, often involute, usually 4-9 per culm 1. E. canadensis

   2. Glumes acicular, usually 10-30 mm long; inflorescences lax, often hanging vertical; leaf blades thin and flat

      3. Palea 8-9 mm long; its apex obtuse, hairy at the tip . . . . . 2. E. diversiglumis

      3. Palea 9.5-12 mm long, acute, notched at the tip; leaf blades 10-18 per culm . . . . . 3. E. wiegandii

1. Awns straight when mature and dry

   4. Glumes strongly indurate, terete in cross section and bowed-out near the base, 1-2 mm wide in the upper portion. . . . . 4. E. virginicus

4. Glumes thin and flat, usually 0.4-0.8 mm wide, not strongly bowed near the base.

5. Leaf blades and sheaths glabrous; spikelets with 2-4 florets; glumes and lemmas scabrous; palea of the lower floret 7-8 mm long; rachis joints 3-8 mm long . . . . . 5. E. riparius

5. Leaf blades softly villous above; sheaths villous to glabrous; palea of lower floret 5-7 mm long; rachis joints 1.5-3.0 mm long. . . . . 6. E. villosus

1. Elymus canadensis L. Canada wildrye Fig. 59; Map 64.

This species is extremely common and widespread in Iowa, forming extensive roadside colonies and occurring also on native prairies, railroad rights-of-way, lake shores, and open ground. July-September.

This species is highly polymorphous. The following types of variation, among others, may be seen among our specimens:

1. Density of inflorescence: Very congested to somewhat lax and open.
2. Number of spikelets: The range is from the normal two per node to four or more.
3. Pubescence of spikelets: The lemmas may be hirsute, scabrous, or glabrous.
4. Width of glumes: 0.5 - 1.5 mm.
5. Induration of bases of glumes.
6. Color: Leaves and spikelets may be green or strongly glaucous.

These characteristics appear to vary independently, and no distinct varieties can be recognized. The plants frequently grow interspersed with E. virginicus, and natural hybrids with that species have been detected in Iowa (Pohl, 1959) and elsewhere (Brown and Pratt, 1960). It appears very probable that some of the variability in this species, as well as in E. virginicus, is due to past hybridization.

Chromosome number S=28 (Hartung, 1946).

Quebec to southern Alaska, southward throughout the U.S. except for the southeastern states.

2. Elymus diversiglumis Scribn. and Ball. Map 65.

Known from Iowa only by the following specimen, which was identified by Dr. G. L. Church.

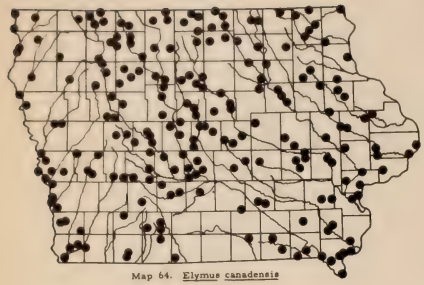
Emmet Co.: Estherville: Oak Hill. B.O. Wolden 530. July 12, 1922 (ISC).

3. Elymus wiegandii Fern. Map 66.

Rare; known from Iowa only by the following specimens, all from the extreme northern counties.

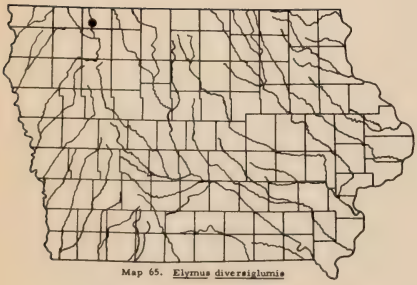
Dickinson Co.: Ungrazed woods along the Little Sioux River, 2 mi. w. of Milford, Sec. 10, Okoboji Twp. R. L. Thorne 13223. Aug. 7, 1953 (ISC). Emmet Co.: High Lake woods. B.O. Wolden 566. July 29, 1922 (ISC). Winneshiek Co.: Prairie openings on ridges, Decorah. B. Shimek, Aug. 22, 1903 (IA).

Chromosome number S=28 (Brown, 1948; Bowden, 1959).

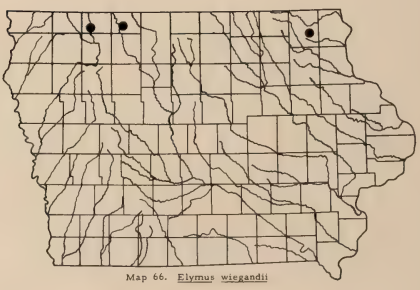


Map 64. Elymus canadensis

Figure 59. Elymus canadensis



Map 65. Elymus diversiglumis



Map 66. Elymus wiegandii

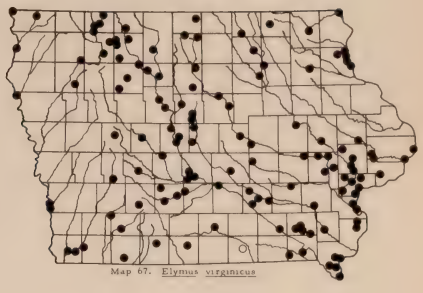


Figure 60. Elymus virginicus

4. Elymus virginicus L. Virginia wildrye Fig. 60; Map 67.

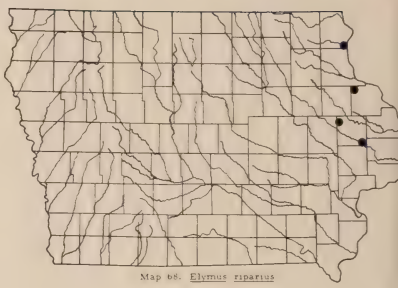
Common throughout the state; roadsides, open woods, ditches, shores of lakes, prairies; especially common on flood plains. Late June-Sept.

This is an extremely diverse species. Our specimens exhibit variation in the following characteristics, among others: 1. Width of upper portions of glumes: 1-2 mm. 2. Degree of induration of glume bases. 3. Pubescence of spikelets: Some individuals have glabrous lemmas, others are strongly hirsute. 4. Pubescence of rachis: Glabrous, scabrous, or hirsute. 4. Degree of bowing of glume bases. 6. Exsertion of spikes. 7. Color of plant: Green or glaucous. 8. Presence or absence of awns.

As in the case of E. canadensis, the variable characters are poorly correlated. While numerous named varieties or forms have been proposed, the variation is so extreme as to suggest that no system of infraspecific categories will be meanigful. Probably a great deal of the observed variation in our plants can be accounted for on the basis of recent or remote hybridization with E. canadensis (Brown and Pratt, 1960; Church, 1954, 1958; Pohl, 1959).

Chromosome number S=28 (Brown and Pratt, 1960).

Newfoundland to Florida, westward to Alberta, Washington, and Arizona.



Map 68. Elymus riparius

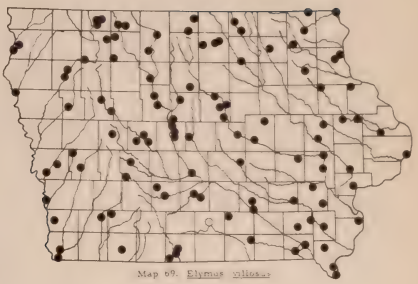
Figure 61. Elymus riparius

5. Elymus riparius Wieg. Fig. 61; Map 68.

Rare, in woods; northeastern Iowa, mostly near the Mississippi River and also in Woodman's Hollow. August-September.

Chromosome number S=28 (Church, 1958; Brown, 1958).

Quebec to North Carolina, westward to Wisconsin, Nebraska, Kansas and Arkansas.



Map 69. Elymus villosus

Figure 62. Elymus villosus

6. Elymus villosus Muhl. Fig. 62; Map 69.

Perennial, tufted. This is a common species of woodlands throughout Iowa. The species is quite uniform and distinct. Several minor variants occur rarely. Forma arkansanus (Scribn. and Ball) Fernald has nearly glabrous spikelets. It has been found sporadically in the western half of Iowa. A form with glumes slightly wider and more ridged and indurate than usual, has been celled E. striatus var. ballii Pammel (type from Johnson County, in ISC). The specimens so named by Pammel, and a few similar later collections, suggest possible introgression from E. virginicus, approaching what sometimes has been called E. virginicus f. hirsutiglumis. Late June-September.

Chromosome number S=28 (Nielsen and Humphrey, 1937).

South Carolina, westward to the Dakotas, Wyoming, and Texas.

24. X ELYHORDEUM Mansf. Der Züchter 25:164 (1955)
(X ELYMORDEUM Lepage Nat. Canad. 84:97 (1957))

This hybrid genus consists of hybrids of species of Elymus with species of Hordeum. Spikes solitary, terminal; spikelets usually 3 (2-7) per node; florets 1-4, completely sterile; lateral spikelets somewhat pedicellate, the central one sessile and slightly larger; rachis disarticulating at the nodes.

Literature

Bowden, Wray. 1958. Natural and artificial X Elymordeum hybrids. Canad. J. Bot. 36:101-123.

Pohl, Richard W. 1966. X Elyhordeum iowense, a new intergeneric hybrid in the Triticeae. Brittonia 18:

The following two hybrids of this parentage are known from Iowa:

X Elyhordeum montanense (Scribn. in Beal) Bowden
X Elymordeum montanense (Scribn. in Beal) Bowden Canad. J. Bot. 36:109.
Hordeum montanense Scribn. in Beal
Hordeum pammelii Scribn. and Ball

This taxon is represented in our collections by only one Iowa specimen, the isotype of Hordeum pammelii. The spikelets usually bear two florets, which excludes them from the genus Hordeum. The pollen grains are collapsed and shrunken. Bowden states that E. montanense is a hybrid between Elymus virginicus and Hordeum jubatum. Our specimen resembles Hordeum jubatum in having a fragile rachis, but is similar to Elymus in having several florets. The Iowa specimen is cited below:

Humboldt Co.: Dakota City, near C.& N.W.R.R. August 8, 1896. L.H. Pammel (ISC).

Chromosome number S=28. Many meiotic abnormalities were reported by Bowden.

Nova Scotia and Quebec, westward to Saskatchewan and Montana, southward to Illinois, Iowa, and South Dakota.

X Elyhordeum iowense Pohl

These hybrids occur in considerable number at the site given below. They are the product of repeated crosses between Hordeum jubatum and Elymus villosus, resembling the former species in their fragile rachis, 3 spikelets per node, and long awns. They resemble E. villosus in having several florets and in the pubescence of the leaves and many other characters. All of the 75 to 100 clumps discovered are completely sterile.

Story Co.: E. side of county line road, ca 1/2 mi. s. of Hy. 30, s. of Drive-In Theatre, w. of Ames; scattered along grassy road ditch for about 1/10 of a mile; with Elymus villosus and Hordeum jubatum. Pohl 9743. June 21, 1965 (TYPE).

Chromosome number S=28; from root tips.

25. HYSTRIX Moench.

Tufted perennials; inflorescence a very open spike, with usually one or two horizontally spreading spikelets at each node; spikelets several-flowered; glumes usually reduced to rudiments.

While spikelets of Hystrix patula commonly lack developed glumes, the species exhibits great variation in this respect. Of 76 Iowa specimens examined, 41% bore at least one evident glume on the spike. Some plants possessed only one or a few glumes per spike, while others had well-developed glumes on nearly all spikelets. In nearly all cases, the glumes were acicular and nerveless. They ranged from 2.5-17 mm long. Forty-eight per cent of the plants of the pubescent phase (f. bigeloviana) had developed glumes, while 38% of the glabrous plants showed similar development. Church (1954) states that the development of glumes in Hystrix is not necessarily a sign of hybridization with species of Elymus, and that hybrids between several species of Elymus and Hystrix patula failed to survive to maturity.

1A. Hystrix patula (L.) Moench, f. patula Bottlebrush Grass
Fig. 63; Map 70.

Spikelets glabrous. Common in moist woods. Late June-September. The delicate spikes are fragile, the florets dropping at a touch.

Nova Scotia to Georgia, westward to North Dakota and Arkansas.

Chromosome number S=28 (Brown, 1948).

1B. Hystrix patula, f. bigeloviana (Fernald) Gleason. Phytologia 4:21 (1952).

Spikelets pubescent. Scattered, moist woods, mostly in the northwestern half of the state.

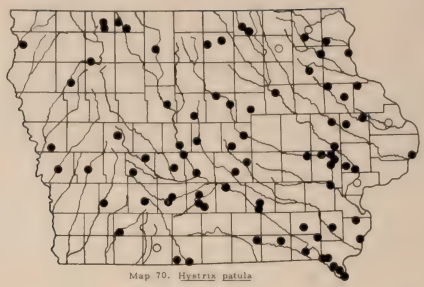
26. HORDEUM L. Barley

Plants annual or perennial; tufted; spikelets in triads at each node of the rachis, single-flowered; central spikelet of each triad fertile; back of the lemma turned away from the rachis; rachilla prolonged behind the palea as a naked bristle; lateral spikelets often pedicellate, similar to the central one or reduced to sterile awned rudiments; rachis of spikes persistent or commonly fragile, disarticulating at the base of each segment, each joint falling attached to the triad of spikelets borne at its apex. Such inflorescence segments are capable of burrowing into the facial tissues of animals, especially sheep, and inflicting severe mechanical injury.

Literature

Covas, G. 1949. Taxonomic observations on the North American species of Hordeum. Madroño 10:1-21.

Aberg, Ewart. 1940. The taxonomy and phylogeny of Hordeum L., Sect. Cerealia Ands. Symb. Bot. Upsal. IV: 2:1-156 + pl. I-XX.



Map 70. Hystrix patula

Figure 63. Hystrix patula

Key to Species

1. Rachis solid, not disarticulating at maturity; cultivated plants. . . . . 1. H. vulgare

1. Rachis fragile, disarticulating at the base of each segment; wild plants.

2. Lateral spikelets sessile; some spikelets two-flowered. . . . . 4. X Elyhordeum montanense (Genus 24)

2. Lateral spikelets on short pedicels; all spikelets single-flowered.

3. Both glumes of central spikelets and inner glumes of lateral spikelets flat, broadened above their bases; awns about as long as the florets. . . . . 3. H. pusillum

3. All glumes thread-like, many times longer than the florets. . . . . 2. H. jubatum

1. Hordeum vulgare L. Barley Fig. 64.

Cultivated barley is grown as a crop plant in Iowa and may occasionally be found as a stray growing from scattered seed.

Most strains of cultivated barley are six-rowed, that is, possessing groups of three fertile spikelets at each node. Two-rowed barleys, in which the lateral two spikelets of each triad are sterile and reduced in size, are also occasionally grown. Another odd variant is the so-called "hooded barley" in which the lemma bears, in inverted position at the tip, a hooded body which is morphologically a rudimentary floret (Arber, 1934, pp. 312-316). In this strain, awns are lacking.

Barley is a native of the Old World. It is grown for feed grain, human food, and the production of malt.

2. Hordeum jubatum L. Squirrel-tail Barley Fig. 65; Map 71.

Tufted perennial; very common on disturbed ground or weedy grassland. May-September.

Chromosome number S=14, 28 (Darlington and Wylie, 1955).

Boreal America southward to Maryland, Missouri, Texas and California; much less common in the eastern states.

3. Hordeum pusillum Nutt. Little Barley Fig. 66; Map 72.

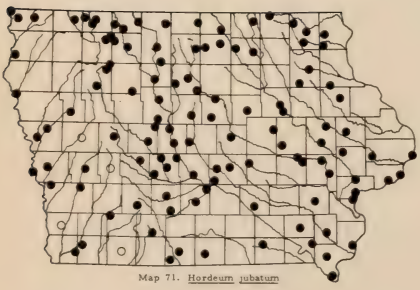
Annual, tufted. Common in open fields, pastures, on road embankments, loess bluffs, sand plains. May-July.

Chromosome number S=14, 28 (Darlington and Wylie, 1955).

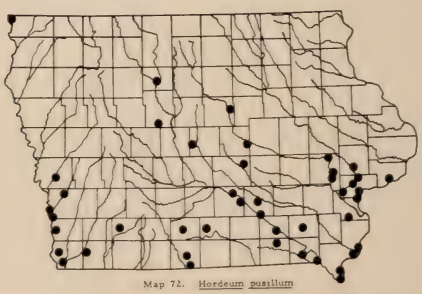
Throughout the United States; common in the western states.

4. X Elyhordeum montanense: See Elyhordeum (Genus 24).

Figure 64. Hordeum vulgare



Map 71. Hordeum jubatum



Map 72. Hordeum pusillum

Figure 65. Hordeum jubatum
Figure 66. Hordeum pusillum

27. X AGROHORDEUM G. Camus

Hybrid plants, intermediate between Hordeum and Agropyron; spikes terminal, balanced, with a thin, flat disarticulating rachis, separating at the base of each segment; each segment bearing one to several spikelets; spikelets several-flowered.

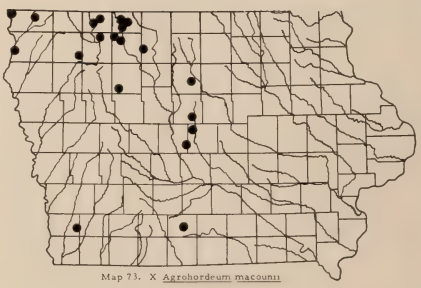


Figure 67. X Agrohordeum macounii

X Agrohordeum macounii (Vasey) Lepage Nat. Canad. 79:242 (1952). Fig. 67; Map 73.

Boyle and Holmgren (1955) have shown that the so-called Elymus macounii is a collection of hybrids between Agropyron trachycaulum and Hordeum jubatum. They were able to resynthesize this hybrid by massive open pollination of individual female parent plants. The artificial hybrids were very similar to naturally occurring ones. These authors found that their plants frequently had two spikelets per node at the base of the spike (therein simulating Elymus species), followed by single spikelets having three glumes and then by normal single spikelets. The same situation is to be found in Iowa plants.

These hybrids are occasionally found with one or both parents in northern Iowa. They have been found on prairies, roadsides, around spring basins and in marshy areas. Frequently the habitat is disturbed or overgrazed. The plants are completely sterile and are presumably all F_1's. Examination of spikelets of our specimens shows small, abortive anthers. There is seldom any development of the ovary unless infection with the ergot fungus, Claviceps purpurea, has occurred. Iowa specimens are rather uniform in aspect, the principal variation being in leaf width. Late June-early September.

Chromosome number S=28. This count was obtained by Nielson (1939) from root tips. Gross cytological abnormalities occur in meiosis (Boyle and Holmgren, 1955).

Iowa and Minnesota to Alaska, New Mexico, and California. Artificial hybrids of Hordeum jubatum x Agropyron trachycaulum with S=28 were produced by Gross (1960), and some of these were converted into artificial octoploids (S=ca. 56) by colchicine treatment.

TRIBE 6. PHALARIDEAE

28. PHALARIS L.

Plants annual or perennial; tufted or rhizomatous; panicles dense, ovoid or cylindrical; glumes equal, keeled, longer than the floret; disarticulation above the glumes; fertile floret one, falling with two minute sterile florets attached at its base; lemma smooth and shining, coriaceous.

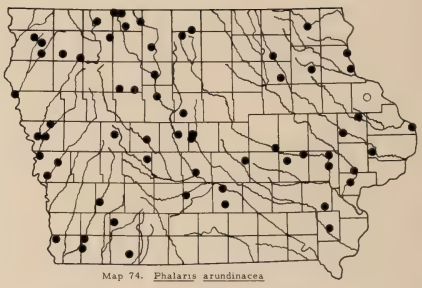
Literature

Anderson, D.E. 1961. Taxonomy and distribution of the genus Phalaris. Iowa State J. Sci. 36:1-96.

Key to Species

1. Plants rhizomatous; glumes not winged; panicle cylindrical, often lobed. . . . . 1. P. arundinacea

1. Plants tufted, annual, without rhizomes; glumes broadly winged, green and white striped; panicle dense, ovoid. . . 2. P. canariensis



Map 74. Phalaris arundinacea

Figure 68. Phalaris arundinacea

1. Phalaris arundinacea L. Reed Canary grass Fig. 68; Map 74.

Tall rhizomatous perennial; common on marshy ground and in ditches; particularly abundant along the flood plains of the Missouri and Mississippi Rivers. Late May-July.

Reed canary grass has been recommended as a forage crop for wet lands, and for stabilizing gullies and ditches. It is probably planted to a minor extent. Chromosome number S=14, 28 (Avdulov, 1931); S=28, 27, 29, 30, 31, 35 (Hanson and Hill, 1953).

Boreal America, southward to North Carolina, Arizona, and northern California; Eurasia.

Figure 69. Phalaris canariensis

2. Phalaris canariensis L. Canary grass Fig. 69; Map 75.

Tufted annual. Canary grass forms a portion of the seed mixtures fed to caged birds, hence plants are frequently found in areas where household refuse is dumped. Apparently this species is not able to maintain itself from year to year in the wild under our conditions. June-August. Chromosome number S=12 (Avdulov, 1931; Hanson and Hill, 1953). Introduced from the Mediterranean area.

29. HIEROCHLOË R. Br.

Plants perennial; culms arising singly or in small clusters from extensively creeping slender rhizomes; inflorescence a pyramidal panicle; spikelets brownish, shining; glumes longer than the florets, translucent; two lower florets staminate, covering the perfect terminal floret, all three falling as a unit from the glumes.

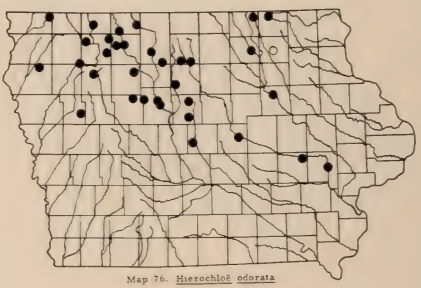


Figure 70. Hierchloë odorata

Hierchloë odorata (L.) Beauv. Holy Grass Fig. 70; Map 76.

Holy grass is widely distributed in northwestern and north central Iowa. It is not common, but may occasionally be found on low, moist prairie or around the edge of sedge marshes and hanging bogs. The plants have the delectable vanilla-like odor of coumarin, which is retained upon drying. Late April-early July.

Arctic North America southward to the northeastern and north central states, and in western mountains to Arizona and New Mexico; Eurasia.

Chromosome numbers S=28, 56 (Myers, 1947); 42 (Tateoka, 1954); 56 (Bowden, 1960B).

TRIBE 7. MELICEAE

30. MELICA L.

Perennial; cespitose; sheaths closed; panicles with few, distant branches; spikelets disarticulating below the glumes and between the florets; uppermost several florets reduced, sterile, convolute, forming a club-shaped structure; lemmas obtuse, the conspicuous nerves running nearly parallel.

Figure 71. Melica nitens

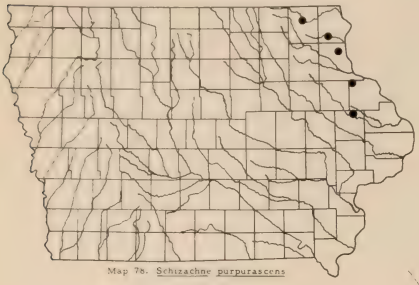
Melica nitens (Scribn.) Nutt. Fig. 71; Map 77.

Rare; wooded slopes in eastern and central Iowa. Late May-July. Chromosome number S=18 (Boyle, 1945).

Pennsylvania and western Virginia to southeastern Minnesota and eastern Nebraska, to Texas and northeastern Mexico.

31. SCHIZACHNE Hack.

Slender woodland perennial; sheaths closed; spikelets few, borne in a racemiform slender panicle; spikelets disarticulating above the glumes and between the florets; glumes purple; lemmas awned between two teeth, with a tuft of ascending hairs on the callus; palea pubescent along the upper half of the keels.



Map 78. Schizachne purpurascens

Figure 72. Schizachne purpurascens

Schizachne purpurascens (Torr.) Swallen. Fig. 72; Map 78.

Tufted; or with short ascending rhizomes. Rare, in cool rocky woods in Allamakee, Clayton and Dubuque Counties. Chromosome number S=20 (Boyle, 1944).

Boreal North America, from Alaska to Newfoundland, southward to the mountains of Maryland; West Virginia and Kentucky to northeast Iowa, the Dakotas, and Rocky Mountain States.

32. GLYCERIA R. Br.

Perennials; rhizomatous; leaf sheaths closed; spikelets shattering very freely; lemmas awnless, parallel-veined, the apex usually very obtuse; plants of wet habitats or shallow water. The plants are succulent and may provide some forage, but are not cultivated.

Key to Species

1. Spikelets cylindrical, 1-several cm long.
   2. Lemmas scaberulous between the nerves; first glume 2-4 mm long . . . . . 2. G. septentrionalis
   2. Lemmas glabrous between the nerves; first glume 1-2 mm long. . . . . 1. G. borealis
1. Spikelets ovate or oblong, flattened, 7 mm or less long.
   3. First glume 0.5-1.0 mm long; stamens 2. . . . 4. G. striata
   3. First glume 1.2-1.9 mm long; stamens 3. . . . . 3. G. grandis

1. Glyceria borealis (Nash) Batch. Fig. 73; Map 79.

Rhizomatous, succulent; marshes and lakes, growing in water up to 2 feet deep. June-August. This species is found in the lake region of the northwestern counties and Pilot Knob State Park and is apparently rare. Chromosome number S=20 (Church, 1949; Bowden, 1960A).

Newfoundland to northern Pennsylvania, westward to Iowa, the Dakotas, Rocky Mountain and Pacific Coast states and Alaska.

2. Glyceria septentrionalis Hitch. Fig. 74; Map 80.

Rhizomatous, succulent; shallow water and wet ground; more widespread than the previous species, but apparently not common. June-September. Chromosome number S=40 (Church, 1949).

Eastern U.S. and southern Canada, westward to Minnesota and Texas.

3. Glyceria grandis S. Wats. Fig. 75; Map 81.

Rhizomatous; culms thick and spongy; marshy ground and shallow water; widely distributed in the northern half of the state. Late June-August. Chromosome number S=20 (Church, 1949; Bowden 1960A).

Northern North America, from Nova Scotia to Virginia, westward to Alaska, Nebraska, and the Rocky Mountain States.

4. Glyceria striata (Lam.) Hitch. Fig. 76; Map 82.

Marshes, wet banks, damp woods; occasionally in shallow water. This is the commonest and most widely distributed species of the genus in Iowa, to be expected wherever any extensive area of marshy ground exists. Late May-July. Chromosome number S=20 (Church, 1949; Bowden, 1960A).

Labrador to central Alaska, southward to Florida and Mexico.

Plants from the Far North may have somewhat narrower leaf blades. These have been designated as var. stricta (Scribn.) Fernald.

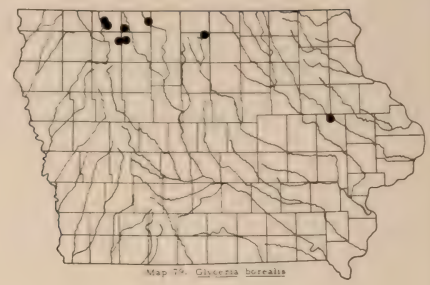
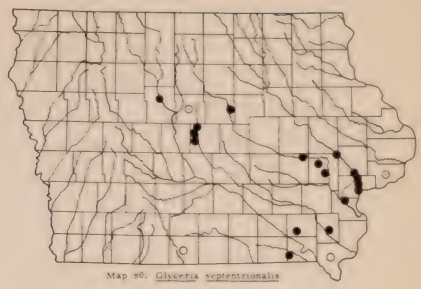
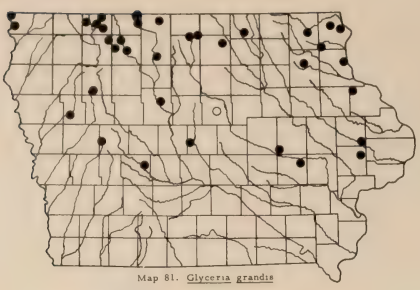


Figure 73. Glyceria borealis



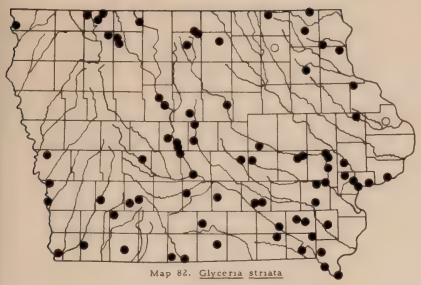
Map 80. Glyceria septentrionalis

Figure 74. Glyceria septentrionalis



Map 81. Glyceria grandis

Figure 75. Glyceria grandis



Map 82. Glyceria striata

Figure 76. Glyceria striata

TRIBE 8. BRACHYELYTREAE

33. BRACHYELYTRUM Beauv.

Erect perennial woodland grasses; culms in clumps, arising from matted crowns; inflorescence a very slender, erect, long-exserted, few-flowered panicle; spikelets single-flowered, the floret awned, much exceeding the very reduced glumes; keels of palea prolonged into awn-points; rachilla prolonged behind the palea as a slender bristle nearly the length of the lemma, and often bearing a minute rudiment at its tip.

Brachyelytrum erectum (Schreb.) Beauv. Fig. 77.

Key to Varieties

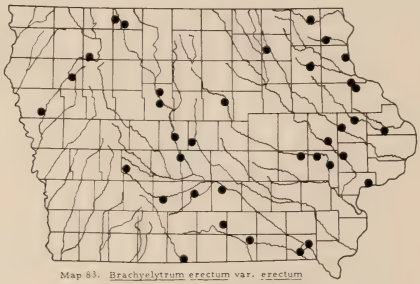
1. Lemma hispid along the prominent nerves, glabrous between nerves. . . . . 1A. var. erectum

1. Lemma short-scabrous on both nerves and internerve areas . . . . . 1B. var. glabratum

1A. var. erectum Map 83.

The typical form of the species is probably to be found in suitable habitats throughout the state. Dense woods. June-August. The florets are very readily deciduous.

Massachusetts to Georgia, westward to Iowa, Kansas, and Louisiana.



Map 83. Brachyelytrum erectum var. erectum

1B. var. glabratum (Vasey) Koyama and Kawano. Canad. J. Bot. 42:866 (1964). = Var. septentrionale Babel. Rhodora 45:260 (1943).

The northern form of this species has been found only twice in Iowa. The specimens are cited below.

Clayton Co.: Near McGregor. July 1, 1934. Jess Fults (ISC); Van Buren Co.: Washington Twp. June 19, 1934. C. L. Gilly and M. McDonald 1969 (ISC).

Newfoundland to Connecticut and New Jersey, westward to Minnesota and Iowa; in the Appalachians southward to Virginia.

Chromosome number S=22 (Brown, 1950; Bowden, 1960A).

Figure 77. Brachyelytrum erectum

TRIBE 9. STIPEAE

34. STIPA L.

Tufted perennials; inflorescence a generally contracted panicle; glumes longer than the floret, hyaline or papery; floret terete, with a hard, sharp oblique hairy callus; lemma stiff and hard, its edges overlapping the palea; awn jointed to the apex of the lemma, twisted and usually twice bent. This genus and its close relatives are among the oldest known grasses, their fossils having been found in the Miocene formations of the Great Plains (Elias, 1942).

The floret of species of Stipa is a complex self-planting device. The exceedingly sharp, hard callus, aided by the upwardly-directed callus hairs, is easily able to bury itself in the soil (or occasionally in the wool or hair of animals). The spirally-twisted first segment of the awn is hygroscopic, uncoiling when damp, and coiling when dry. These movements permit the awn to act as a ratchet, literally screwing the floret into the soil. When florets become imbedded in the hair or wool of animals, serious puncture wounds and blindness may ensue.

Key to Species

1. Awn 2-3 cm long; lemma spindle-shaped. . . . . 3. S. viridula

1. Awn 10-20 cm long; lemma cylindrical

   2. Awn with one definite bend, the upper segment loosely spiral; glumes 2 cm or less long. . . . . 2. S. comata

   2. Awn with two sharp bends, the upper segments straight; glumes 3-4.5 cm long. . . . . 1. S. spartea

1. Stipa spartea Trin. Porcupine Grass Fig. 78; Map 84.

Tufted perennial; common on dry roadsides, prairie relicts, loess bluffs. Late May-June. Chromosome number S=44 (Tateoka, 1955).

Ontario to British Columbia, southward to Ohio, Missouri, and New Mexico.

2. Stipa comata Trin. and Rupr. Needle-and-Thread Fig. 79; Map 85.

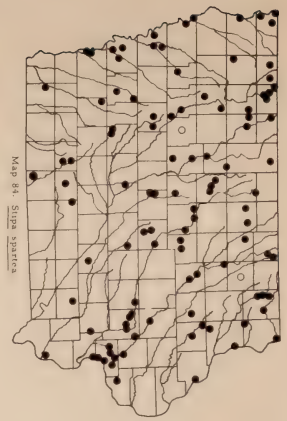
This is a species of the Great Plains and the western mountain states, which rarely occurs as an adventive in the north central states. Our only records from Iowa are the following, presumably collected from dry bluffs, which support a "western" type flora.

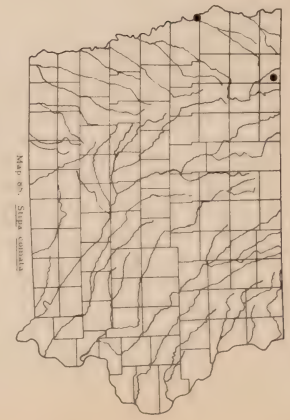
Osceola Co.: Ocheydan Mound; S.W. $\frac{1}{4}$ Sec. 12, Ocheydan Twp. R.F. Thorne 14186, June 26, 1954. Woodbury Co.: Sioux City. A.S. Hitchcock, 188? (ISC).

Chromosome number S = 44–46 (Stebbins and Love, 1941, for var. intermedia); 44 (Bowden, 1960B).

Figure 78. Stipa spartea

Figure 79. Stipa comata





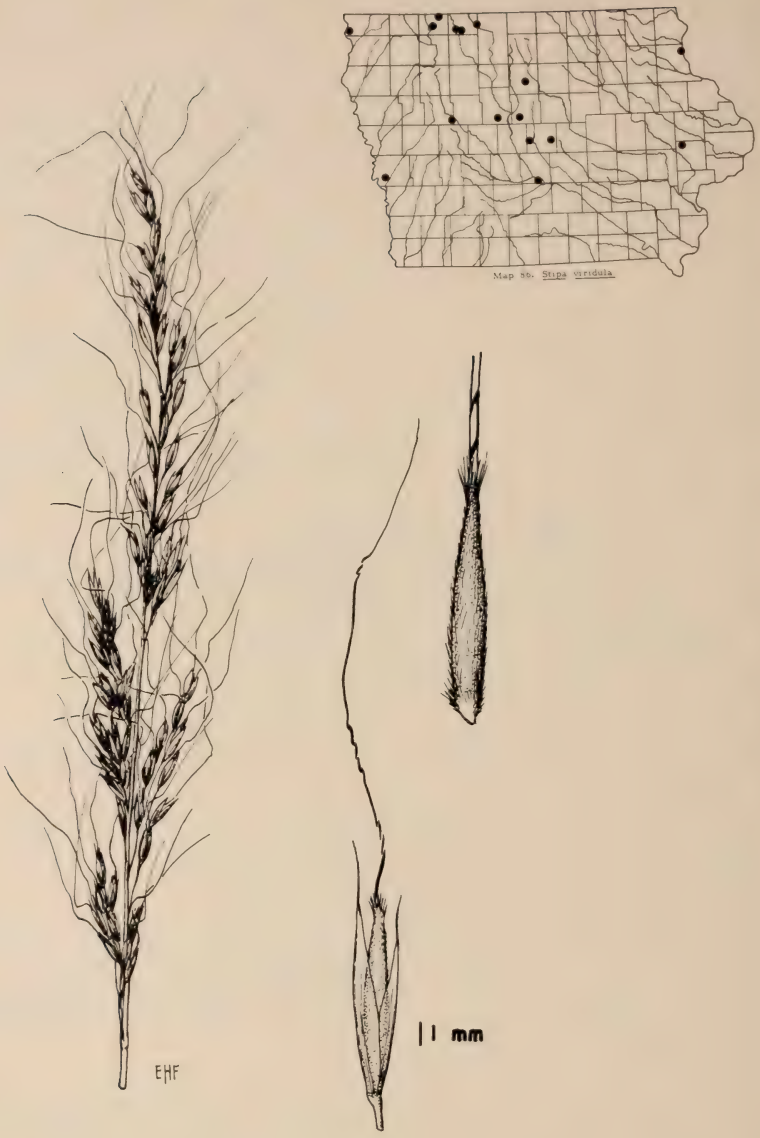


Figure 80. Stipa viridula

3. Stipa viridula Trin. Fig. 80; Map 86.

Tufted perennial; rare, along railroads and roads and on loess bluffs; in Iowa, probably adventive from farther west. June-August.

Chromosome number S=82 (Johnson and Rogler, 1943).

Alberta to Arizona, eastward to Saskatchewan, Wisconsin, Illinois, and New Mexico; adventive in New York.

35. ORYZOPSIS Michx.

Perennial; inflorescence a panicle; spikelets disarticulating above the herbaceous glumes; floret boat-shaped, hard and shining; lemma overlapping the edges of the palea; callus oblique; awn weak, flexuous, readily deciduous from the lemma.

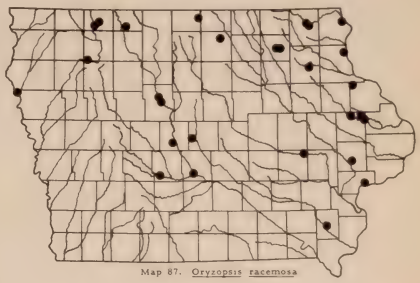

Map 87. Oryzopsis racemosa

Figure 81. Oryzopsis racemosa

Oryzopsis racemosa (J.E. Smith) Ricker. Fig. 81; Map 87.

Forming short, knotty rhizomes or crowns. The floret is blackish, with appressed pubescence on both lemma and palea. Occasional in moist woods, northern and eastern Iowa, south in the Des Moines River Valley to the Ledges and Dallas Co. June-September.

Chromosome number S=46 (De Lay, 1951); 48 (Bowden, 1960B).

Quebec to Virginia, westward to Iowa, Minnesota, and South Dakota.

SUBFAMILY ARUNDINOIDEAE

TRIBE 10. DANTHONIEAE

36. DANTHONIA Lam. and D. C.

Tufted perennials; leaves mostly basal, inflorescence a contracted panicle of few spikelets; spikelets disarticulating above the glumes and between florets; glumes lanceolate, acuminate, exceeding the florets; florets usually 5 or more, awned between 2 teeth; awn flattened, coiled at the base.

Figure 82. Danthonia spicata

Danthonia spicata (L.) Beauv. Poverty oatgrass Fig. 82; Map 88.

Forming circular patches on dry sterile soil, hillsides in thin woods. The basal foliage is curly. The lower sheaths of the culms frequently contain cleistogamous spikelets, or "cleistogenes." These spikelets are self-pollinated and consist of a pair of very reduced glumes and one to several awnless florets, quite unlike those of the panicle. This peculiar type of seed production tends to preserve essentially inbred local races, making the species highly variable. June-July. Occasional in eastern and central Iowa.

Chromosome number S=36 (De Wet, 1954B; Bowden, 1960B).

Newfoundland to British Columbia, southward to Florida, New Mexico and Oregon.

TRIBE 11. ARISTIDEAE

37. ARISTIDA L. Wiregrass, Needlegrass

Plants annual or perennial, tufted; inflorescence an open or contracted panicle; spikelets single-flowered, disarticulating above the glumes; floret cylindrical, the stiff lemma completely enrolling the grain; callus sharp, oblique, bearded with upwardly-directed hairs; awns three, attached at the apex of the lemma, either directly or through a "column" composed of the united bases of all the awns, the central awn often longer than the lateral ones and in some species bent or coiled; palea obsolete.

Cleistogamy is prevalent in this genus. Of our species, A. oligantha, A. basiramea and var. curtissii, A. longespica and A. intermedia appear to be entirely cleistogamous. All of these have one small anther, 0.3-0.5 mm long, lying between the stigmas. Examination of very young florets of A. longespica revealed three anthers, of which two were obviously abortive. Mature spikelets contained only one anther, dehisced between the stigmas. Cleistogamy tends to perpetuate minor differences, such as those of the awn lengths of A. basiramea and its var. curtissii.

Literature

Henrard, J. Th. 1929-32. A monograph of the genus Aristida. Mededeelingen Van's Ryks Herbarium. Leiden. 58 and 58 A. Leiden. Trap.

Kornfeld, Arnold. 1942. A taxonomic study of the genus Aristida in Iowa. Unpublished M.S. thesis, Iowa State Univ. Library.

Shinners, L. H. 1940. Aristida basiramea and its relatives. Am. Midl. Nat. 23:633-634.

Key to Species

1. At least the central awn spirally twisted near the base

   2. Awns all twisted or contorted, united into a column for about 1 cm at the base, the column disarticulating from the lemma . . . . . 1. A. tuberculosa

   2. Only the central awn twisted; awns remaining attached to the lemma

      3. First glume 1/2-3/4 as long as the second

         4. Lateral awns 1/2 or more as long as the central awn . . . . . 2. A. basiramea, var. basiramea

         4. Lateral awns less than 1/2 as long as the central awn . . . . . 2a. A. basiramea, var. curtissii

      3. Glumes nearly equal in length, both surpassing the point of insertion of the awns of the lemma. . . . 3. A. dichotoma

1. Awns straight or bent, none spirally twisted

   5. Awns 4-8 cm long

      6. Glumes nearly equal in length, 2-3 cm long 4. A. oligantha

6. Glumes unequal, the first about 1 cm long, the second about 2 cm. . . . . 8. A. longiseta

5. Awns 2 cm or less long

7. All awns equally spreading and of equal length . 7. A. intermedia

7. Central awn strongly bent, the lateral awns much shorter, erect

8. Lemma about 2 cm long. . . . . 5. A. ramosissima

8. Lemma 4-5 mm long. . . . . 6. A. longespica

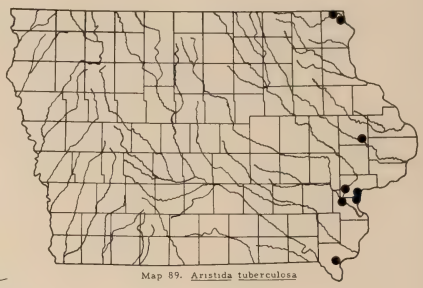
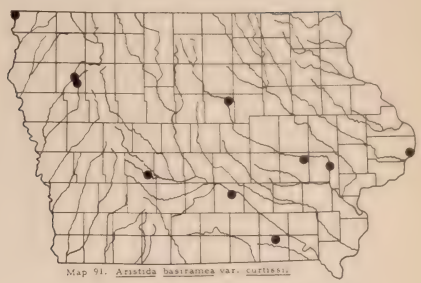

Map 89. Aristida tuberculosa

Figure 83. Aristida tuberculosa

1. Aristida tuberculosa Nutt. Fig. 83; Map 89.

Annual; tufted, much branched. Occasional on sand dunes along the Mississippi River and tributaries in eastern Iowa. August-September.

Atlantic Coastal Plain from Massachusetts to Georgia and Mississippi; Indiana to Minnesota and Iowa.



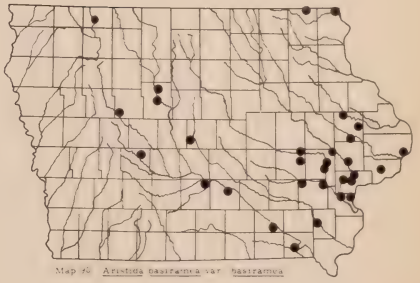


Figure 84A. Aristida basiramea var. basiramea
Figure 84B. Aristida basiramea var. curtissii

2. Aristida basiramea Engelm. ex Vasey var. basiramea Fig. 84A; Map 90.

Annual; tufted. Cleistogamous. Open dry sandy ground, mostly in the eastern half of Iowa. August-September.

Michigan to Tennessee, westward to North Dakota, Colorado and Oklahoma; New England and New York.

2a. Aristida basiramea var. curtissii (A. Gray) Shinners. Am. Midl. Nat. 23:633 (1940). Fig. 84B; Map 91.

A. dichotoma var. curtissii A. Gray.

Annual; tufted; cleistogamous. This variety is similar to the above in growth habit and morphology with the exception of its shorter awns. While some authors have followed Gray in placing this variety under A. dichotoma, it differs from that species in the proportions of glume lengths and in the length of the lemma. August-November.

Scattered in Iowa; common in Gitchie Manitou State Park. Wisconsin to Arkansas, westward to Wyoming and Colorado; occurring as a probable introduction from Pennsylvania and Virginia to Kentucky; Florida.

Figure 85. Aristida dichotoma

3. Aristida dichotoma Michx. Fig. 85; Map 92.

Annual; tufted; dry hillsides. August-October.

Terminal inflorescences bear spikelets which have three large anthers ca 3 mm long and are open-pollinated; basal sheaths contain reduced inflorescences of few spikelets. These spikelets are apparently cleistogamous, each floret containing a single small anther about 0.3 mm long.

Maine to Florida, westward to Wisconsin, Kansas, and eastern Texas. Rare in southeastern Iowa.

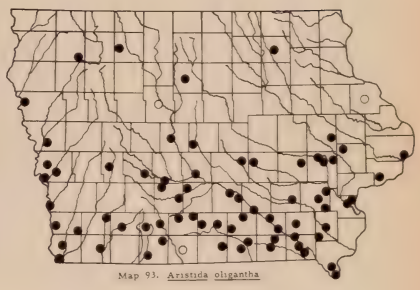


Fig. 86. Aristida oligantha

4. Aristida oligantha Michx. Fig. 86; Map 93.

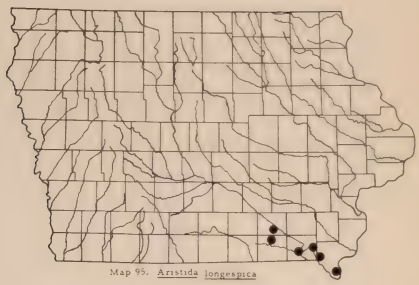
Annual; tufted, often forming large clumps. Open areas, dry soil, loess bluffs, railroad embankments. Common and widespread in Iowa. July-October. Chromosome number S=22 (Gould, 1960).

The plants are cleistogamous, possessing a single small anther about 0.5 mm long which remains in contact with the stigmas after dehiscing.

Massachusetts to Florida, westward to S. Dakota and Texas; Oregon. California, Arizona.

Figure 87. Aristida ramosissima

5. Aristida ramosissima Engelm. ex Gray. Fig. 87; Map 94.
Annual; Tufted.
Known in Iowa only by the following collection: Henry Co.:
Mt. Pleasant, J.R. Mills. 1894 (ISC).
Kentucky to Iowa, southward to Louisiana and eastern Texas.



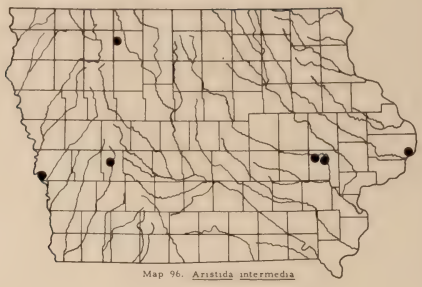
Map 95. Aristida longespica

Figure 88. Aristida longespica

6. Aristida longespica Poir. Fig. 88; Map 95.

Annual; tufted. Dry slopes; rare in Iowa and known only from the counties of the extreme southeast corner of the state. The plants are cleistogamous.

New England to Florida, westward to Iowa, Kansas and Texas.



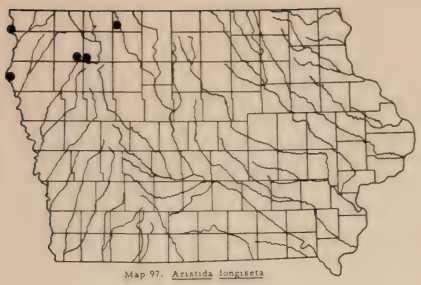
Map 96. Aristida intermedia

Figure 89. Aristida intermedia

7. Aristida intermedia Scribn. and Ball. Fig. 89; Map 96.
A. necopina Shinners Rhodora 56:30 (1954).

Annual; slender, in small tufts. Sandy soil, especially along railroads. The distribution pattern in Iowa seems to indicate spread along east-west railroads. August-September.

Michigan to Nebraska, southward to Florida and Texas.



Map 97. Aristida longiseta

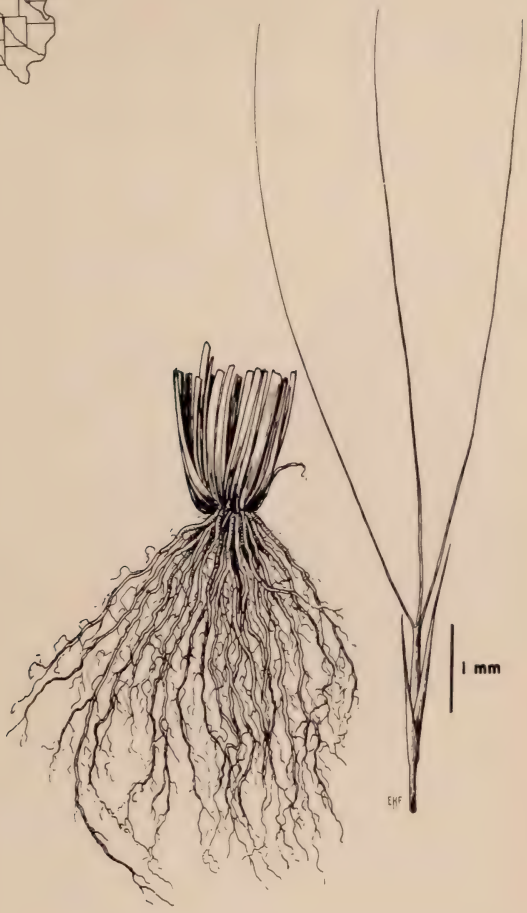


Figure 90. Aristida longiseta

8. Aristida longiseta Steud. Fig. 90; Map 97.

Perennial; in hard tufts. Rare, on loess bluffs and prairie hillsides, northwestern Iowa. Late June-September.

North Dakota, western Iowa to Texas, westward to Washington, Oregon and Arizona.

TRIBE 12. ARUNDINEAE

38. PHRAGMITES Trin. Reed

Tall, strong grasses; perennial, producing widespread stolons and rhizomes; spikelets several-flowered, disarticulating above the glumes; florets disarticulating at the base of each rachilla joint, the joint adhering to the floret above it; rachilla clothed with numerous long ascending hairs, giving the mature spikelets a "cottony" aspect; lowermost floret staminate or sterile.

Literature

Conert, Hans Joachim. 1961. Die Systematik und Anatomie der Arundineae Weinheim. Cramer.

Map 98. Phragmites communis

Figure 91. Phragmites communis

Phragmites communis Trin. Reed Fig. 91; Map 98.

Including var. berlandieri (Fourn.) Fernald. Rhodora 34:211 (1932)

Scattered in Iowa; most common in the northwestern lake region; swamps and lake shores, road ditches; sometimes growing in shallow water. The plants form large colonies by means of their vigorous rhizomes and stolons. The culms may reach four meters in height and bear plumelike panicles up to 40 cm long. Late July-October.

Reed has been found throughout southern Canada and most of the U. S. except in the southeastern states.

Chromosome numbers S=36, 48, ca 96 (Avdulov, 1931).

SUBFAMILY ORYZOIDEAE

TRIBE 13. ORYZEAE

39. LEERSIA Swartz

Plants perennial, rhizomatous; inflorescence a panicle; spikelets strongly flattened laterally, one-flowered; glumes reduced to minute ridges at the apex of the pedicel. The structure of the spikelet has been interpreted variously. The interpretation accepted here is that offered by Agnes Arber (1934, p. 184).

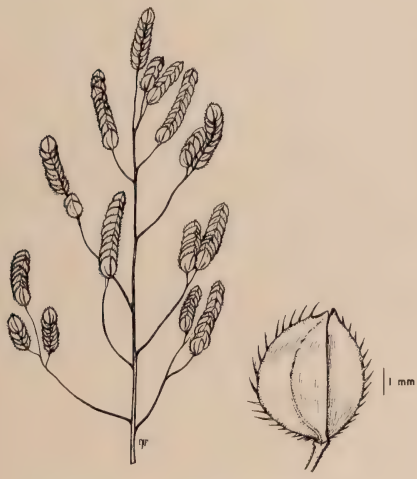
Key to Species

1. Spikelets orbicular, 3-4 mm wide. . . . . 1. L. lenticularis

1. Spikelets elliptic to oblong, 2 mm or less wide

2. Lower panicle branches whorled; rhizomes long and slender, with exposed internodes; spikelets 3.9-6.0 mm long . . . . . 2. L. oryzoides

2. Lower panicle branches solitary; rhizomes short and thick, densely covered with overlapping scales; spikelets 3.0-4.1 mm long . . . . . 3. L. virginica



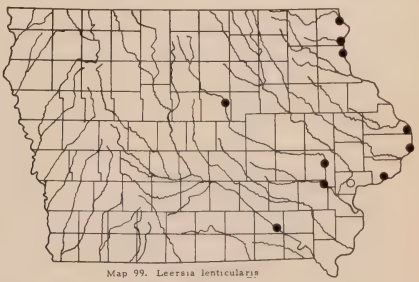

Map 99. Leersia lenticularis

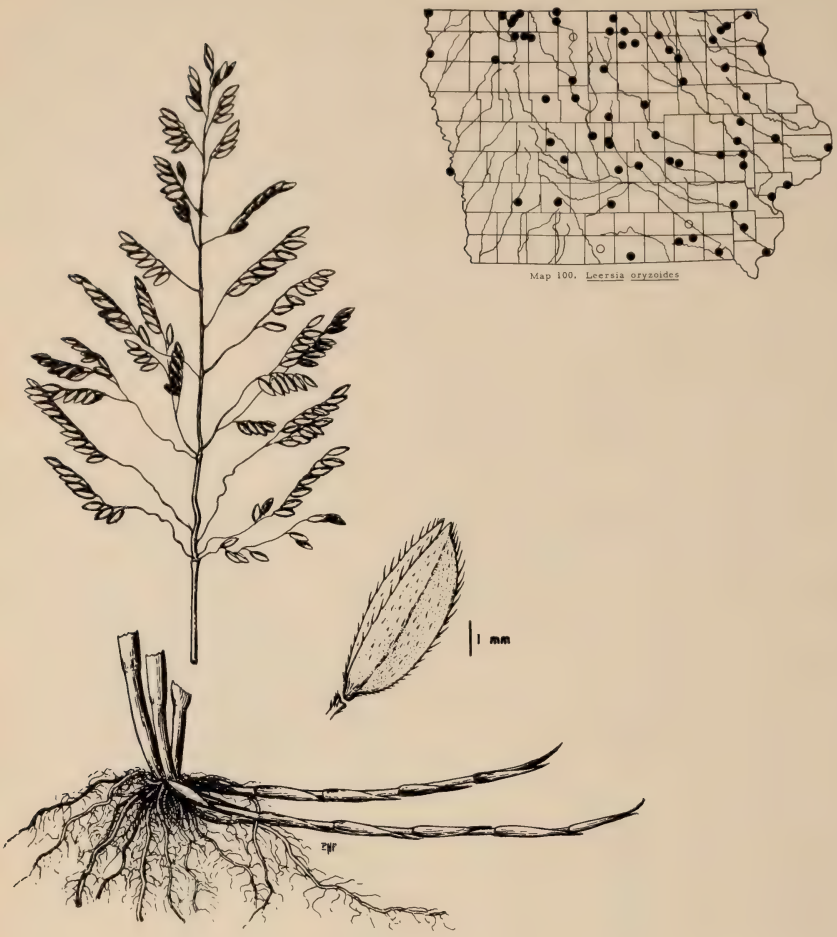
Figure 92. Leersia lenticularis

1. Leersia lenticularis Michx. Catchfly grass Fig. 92; Map 99.

Perennial; sheaths slightly scabrid near their apices. The spikelets are neatly imbricated on each terminal branchlet. In Iowa, this species is rare and is mostly confined to the bottomlands along the Mississippi River and its major tributaries. August-September.

Chromosome number S=24 (Brown, 1950).

Massachusetts to Florida and Texas, northward in the Mississippi Basin to Wisconsin and Minnesota.



Map 100. Leersia oryzoides

Figure 93. Leersia oryzoides

2. Leersia oryzoides (L.) Sw. Cutgrass Fig. 93; Map 100.

Perennial; sheaths strongly scabrous. This is our commonest and most widespread species of the genus. It is frequent on wet banks of lakes and ditches and in swamps. The barbs on the sheaths are strong and sharp enough to inflict scratches.

Cleistogamous blooming occurs late in the season, the inflorescences being nearly hidden in the sheaths. Such plants have been given varietal or formal names, but no evidence has been offered that these plants are genetically distinct from those which flower chasmogamously. Late June-September. Chromosome number S=48 (Brown, 1948).

Throughout the United States and southern Canada; Europe.

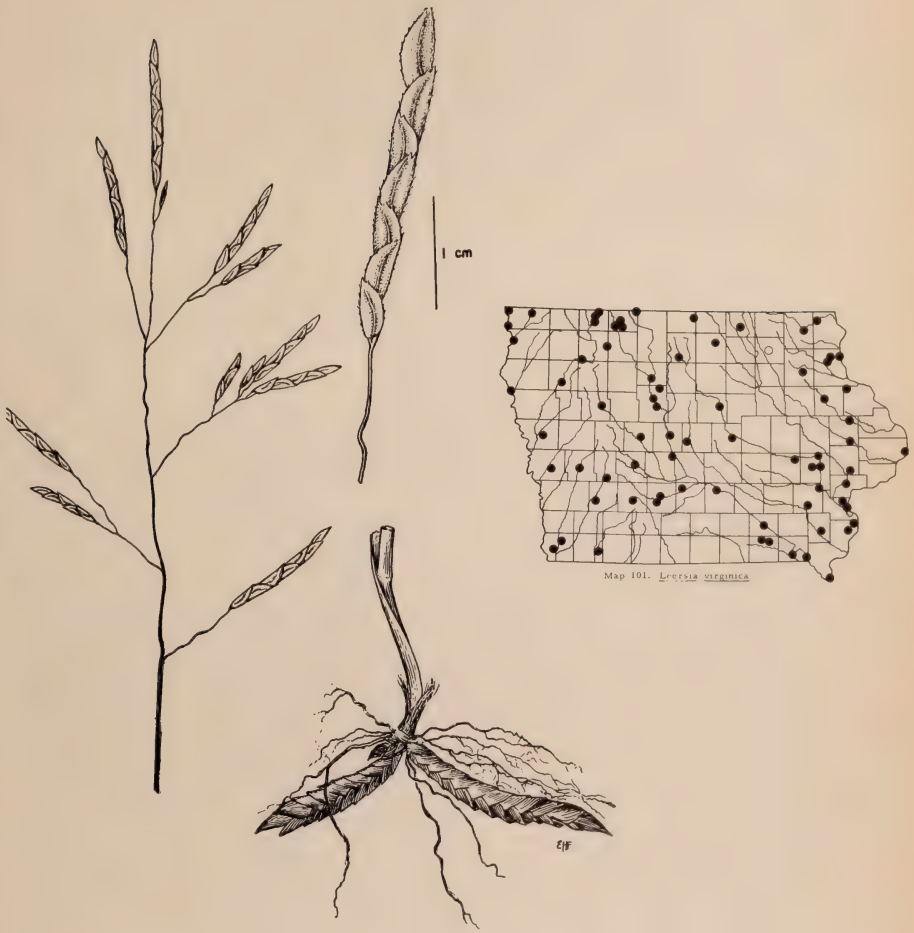


Figure 94. Leersia virginica

3. Leersia virginica Willd. Whitegrass Fig. 94; Map 101.

Perennial; sheaths smooth or nearly so. Moist alluvial woods, wooded ravines, shores of lakes. July-October. Chromosome number S=48 (Brown, 1948).

Quebec to South Dakota, southward to Florida and Texas.

TRIBE 14. ZIZANIEAE

40. ZIZANIA L. Wild Rice

Monoecious aquatic annuals; culms tall, stout, rooted in mud, emergent; spikelets unisexual, borne in a large terminal panicle, the upper branches forming an erect brush and bearing erect pistillate spikelets; lower branches spreading, bearing drooping staminate spikelets; pistillate spikelets one-flowered, awned, disarticulating above the reduced glumes, which form a cupule at the apex of the pedicel; staminate spikelets one-flowered, consisting of a floret which disarticulates above the reduced glumes, which also form a minute cupule. Chromosome number S=30 (Brown, 1948).

Literature

Fassett, N. C. 1924. A study of the genus Zizania. Rhodora 26:153-160.

Key to Varieties

1. Pistillate lemmas thin-textured, dull, scabrous over the surface . . . . . 1a. Z. aquatica var. aquatica

1. Pistillate lemmas firm, glossy, glabrous except at the tip, base, and along the edges

   2. Plants 70-150 cm tall; leaves 4-12 mm wide; ligules 3-5 mm long. . . . . 1b. Z. aquatica var. angustifolia

   2. Plants 90-300 cm tall; leaves 10-40 mm wide; ligules 10-15 mm long. . . . . 1c. Z. aquatica var. interior

1a. Zizania aquatica L. var. aquatica

This variant of the species is known in Iowa only from Lansing, Allamakee Co.

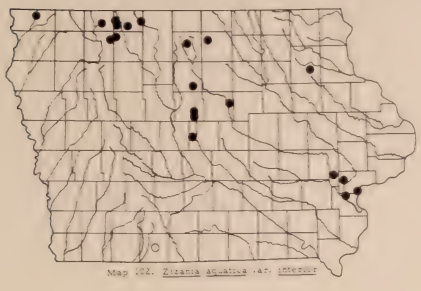
1b. Zizania aquatica var. angustifolia Hitch.

This slender form of wild rice has a smaller, less-branched panicle than the other forms. Specimens approaching this variety have been collected in Iowa only in Dickinson and Lyon Counties.

1c. Zizania aquatica var. interior Fassett. Fig. 95; Map 102.

In Iowa, this is the commonest variant of wild rice. It has been found a number of times in the lakes of the Mankato Lobe, as well as along rivers tributary to the Mississippi in the eastern part of the state. The record from Ringgold County is somewhat doubtful, since this is a well-drained area, where swamps and lakes are lacking. July-August. The spikelets shatter very readily, and the panicles in late season bear few or no florets.

Wild rice ranges from New Brunswick to Florida, westward to North Dakota, Kansas and Louisiana.



Map 102. Zizania aquatica var. interior

Figure 95. Zizania aquatica

SUBFAMILY ERAGROSTOIDEAE

TRIBE 15. ERAGROSTEAE

41. ERAGROSTIS Beauv. Lovegrass

Tufted or stoloniferous annuals or perennials; inflorescence an open or compact panicle; spikelets with 2-many florets; lemmas usually glabrous, 3-nerved, the nerves usually conspicuous. In most species, the lemmas are deciduous at maturity from the rachilla. In a few species, the spikelets disarticulate between the florets.

Key to Species

1. Plants creeping, mat-forming, rooting at the nodes; on wet ground.

   2. Staminate and pistillate spikelets on separate plants; anthers 1.5-2 mm long; panicles dense, resembling clover heads . . . . . 2. E. reptans

   2. Spikelets bearing perfect flowers; anthers less than 0.3 mm long; panicles usually open. . . . . 1. E. hypnoides

1. Plants erect or sprawling, stems not creeping nor rooting at the nodes.

   3. Florets 2-3; spikelets 2-4 mm long

      4. Pedicels of lateral spikelets 2-many times as long as the spikelets; panicles very open, 2/3 or more of the total height of the plant; plants erect; sheaths hairy along the margins. . . . . 3. E. capillaris

      4. Pedicels of lateral spikelets short, usually less than twice as long as the spikelets; panicles compact, about half the length of the sprawling culms; sheaths glabrous except for a few long hairs at the summit. . . . . 4a. E. frankii

   3. Florets 4 or more; spikelets 3 mm or more long

      5. Plants perennial, the culms arising from hard, knotty bases; sharp-pointed buds of next year's growth present at the base of the plant at flowering time; panicles large and open, 20-60 cm long; spikelets reddish or purple

         6. Glumes 2-4 mm long; panicles elongated, cylindrical, their branches flexuous . . . . . 9. E. trichodes

         6. Glumes 1.5-2 mm long; panicles broad, dome-shaped, their main branches stiff and straight 10. E. spectabilis

      5. Plants annual, shallow-rooted; culms arising from soft bases; no basal buds present at flowering time; panicles usually less than 15 cm long; spikelets green or straw-colored.

7. Plants bearing small wart-like glands on keels of lemmas, branches of panicles, or margins of sheaths and blades

   8. Mature spikelets 2.5-3.5 mm wide. . . . . 7. E. cilianensis

   8. Mature spikelets 1.3-2 mm side. . . . . 8. E. poaeoides

7. Plants without wart-like glands.

   9. Spikelets lying closely parallel to the main panicle branches. . . . . 6. E. pectinacea

   9. Spikelets standing away from the panicle branches

      10. Plants erect, bearing terminal panicles only 5. E. pilosa

      10. Plants decumbent, bearing axillary panicles nearly to the base. . . . . 4b. E. frankii var. brevipes

Figure 96. Eragrostis hypnoides

1. Eragrostis hypnoides (Lam.) B.S.P. Fig. 96; Map 103.

Annual. The low (3-15 cm tall) creeping plants form extensive bright-green mats on damp ground along streams and on drying mud. Growth begins in summer and the plants bloom from July to September. This species is widespread in Iowa, but is restricted to wet habitats.

Quebec to Washington and southward to South America; absent from the Rocky Mountains.

2. Eragrostis reptans (Michx.) Nees Map 104, half circle

Annual. The plants closely resemble those of the previous species and have sometimes been confused with it in the past. This species is dioecious and has much larger anthers than the preceding. It is primarily a species of the lower Mississippi Basin, and is known from Iowa only by the following collection:

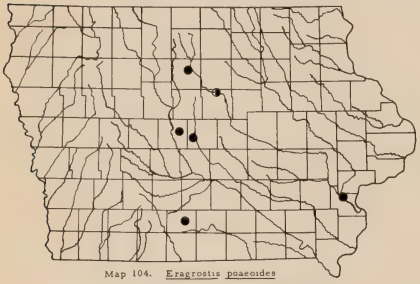
Hardin County: Iowa Falls, M.E. Peck, no date (ISC).

3. Eragrostis capillaris (L.) Nees. Lacegrass Fig. 97; Map 105.

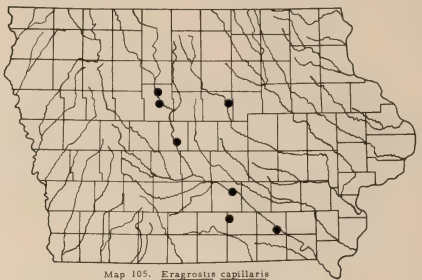
Annual; erect, with very open lacy panicles which makes up most of the height of the plant. Lacegrass is a weed of dry thickets, roadsides, waste ground and fields. Uncommon; south-central and southeastern Iowa. August-September.

Chromosome number S=100 (Gould, 1958).

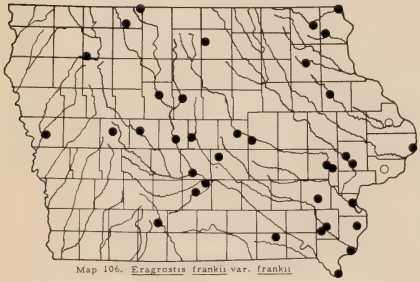
Maine to Wisconsin, Iowa, Kansas and southward to Georgia and Texas.



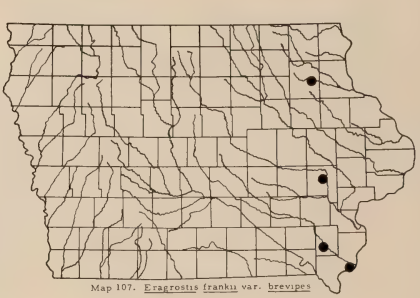
Map 104. Eragrostis poaeoides
Eragrostis reptans (half circle)



Map 105. Eragrostis capillaris



Map 106. Eragrostis frankii var. frankii



Map 107. Eragrostis frankii var. brevipes

4a. Eragrostis frankii C.A. Mey. var. frankii Fig. 98; Map 106.

Annual; sprawling and making bushy tufts; sandy or moist shores of streams; rather widely distributed and apparently fairly common in Iowa. August-September.

New Hampshire to Minnesota, southward to the Gulf of Mexico.

4b. Eragrostis frankii var. brevipes Fassett Map 107.

This variety differs from the typical one in having slightly longer spikelets with 5-7 florets. Rare in Iowa.

Minnesota, southwestern Wisconsin, Illinois, Iowa, and Indiana.

Figure 97. Eragrostis capillaris

Figure 98. Eragrostis frankii

5. Eragrostis pilosa (L.) Beauv. Fig. 99; Map 108.

Annual; tufted; panicles open and delicate. This species is rare in Iowa, having been found only a few times in the southern counties. It occurs as a weed in cultivated fields. July-September.

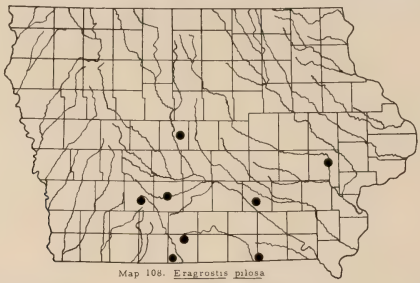
Chromosome number S=40 (Ono and Tateoka, 1953).

Maine to Colorado, southward to Florida and Texas; California. Introduced from Europe.

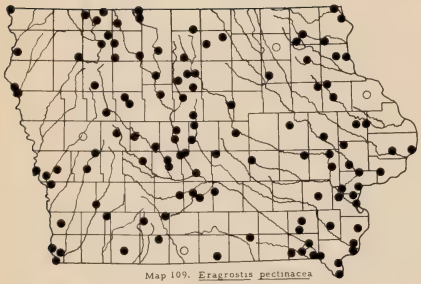
6. Eragrostis pectinacea (Michx.) Nees. Fig. 100; Map 109.

Annual, densely tufted; culms erect or spreading. This is the most common weedy species of Eragrostis in Iowa, and is found in abundance throughout the state; roadsides, fields, waste ground, sandy shores. July-September.

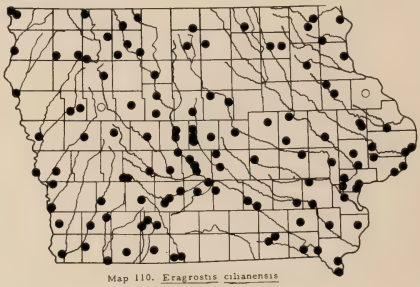
Maine to Florida, westward to Washington and Arizona.



Map 108. Eragrostis pilosa



Map 109. Eragrostis pectinacea



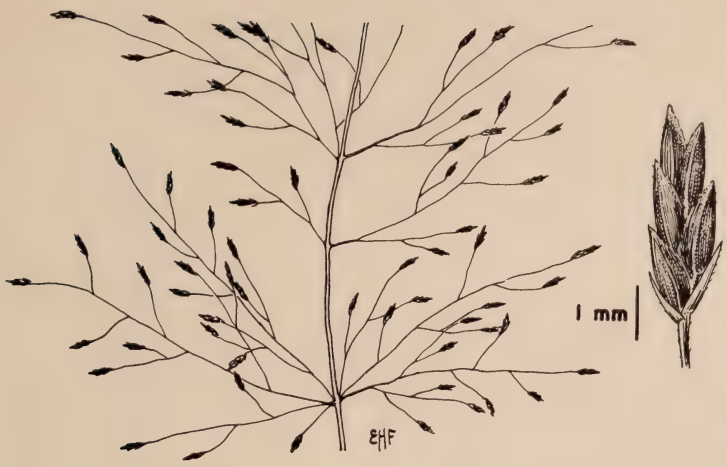
Map 110. Eragrostis cilianensis

7. Eragrostis cilianensis (All.) Lutati Stinkgrass Fig. 101; Map 110.
E. megastachya (Koel.) Link

Annual; tufted, erect or with spreading culms. This species is one of our commonest weedy annual grasses. It is very widely dispersed in Iowa, in corn fields, gardens, on roadsides and waste ground. June-September. Introduced from Europe, and now ranging throughout the United States. Chromosome number S=20 (Tateoka, 1955A).

The name E. megastachya (Koel.) Link has been used for this species in some publications. This usage is apparently based upon the fact that Allioni (1785), who published Poa cilianensis, the basonym of Erogrostis cilianensis, referred to a plant with spikelets of four florets. While Allioni's description does contain this statement, his illustration (tab. 91, fig. 2) shows what is apparently a young plant of stinkgrass, with partially expanded spikelets. In this stage, the spikelets may apparently be four-flowered.

99



100

Figure 99. Eragrostis pilosa

Figure 100. Eragrostis pectinacea

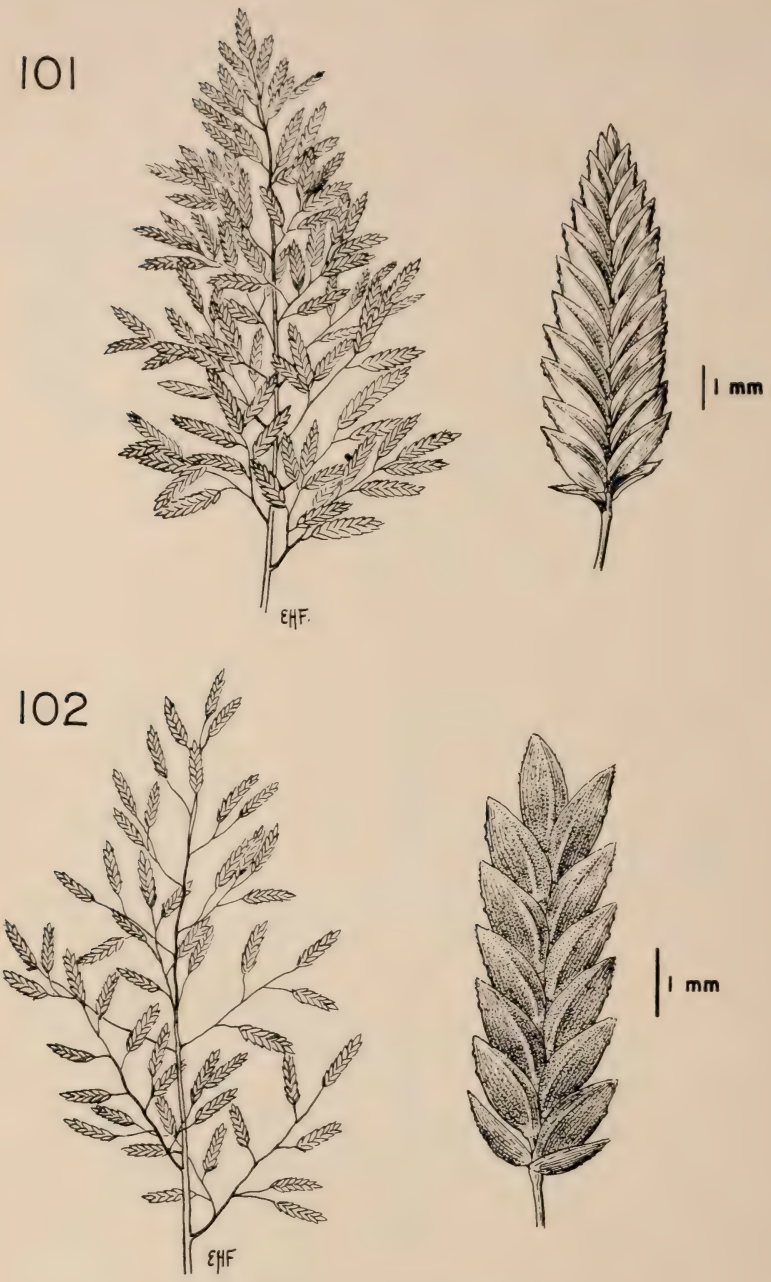


Figure 101. Eragrostis cilianensis

Figure 102. Eragrostis poaeoides

8. Eragrostis poaeoides Beauv. ex Roem. and Schultes
Fig. 102; Map 104

Annual; tufted. This species is rare in Iowa, having been found several times along railroad rights-of-way in central and southern Iowa. It closely resembles the previous species, differing principally in smaller stature and smaller spikelets. Some plants may lack glands on the spikelets. Introduced from Europe.

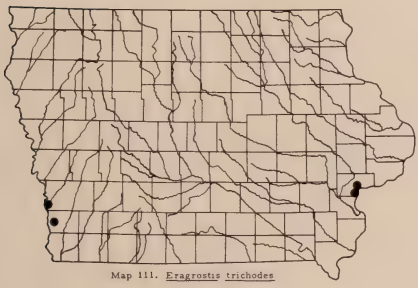
Chromosome number S=40 (Tateoka, 1955), Pohl, unpublished.

9. Eragrostis trichodes (Nutt.) Wood. Sand Lovegrass
Fig. 103; Map 111.

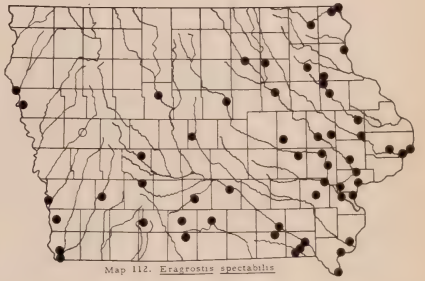
Perennial; forming large dense tufts. Sandy open ground or thin woods. Rare in Iowa. Muscatine Island; Ames; Mills and Pottawatomie Counties, on the Missouri River bottoms.

Texas to Illinois and Colorado.

Eragrostis curvula (Schrad.) Nees, Weeping Lovegrass, is similar to the above, but differs in possessing leaden-gray spikelets. It has been successfully grown in the herbaceous garden at Ames for a number of years. It is an introduction from Africa and is widely planted in the Southwest for forage.



Map 111. Eragrostis trichodes



Map 112. Eragrostis spectabilis

10. Eragrostis spectabilis (Pursh) Steud. Purple Lovegrass
Fig. 104; Map 112.

Perennial; in dense tufts, with numerous sharp-pointed basal buds. The large, dome-shaped panicles may break off at maturity and roll away as tumbleweeds.

Chromosome number S=40 (Nielsen, 1939).

Prairies, open ground, roadsides, especially on sandy soil. Widespread in Iowa but not especially abundant. The sheaths vary from nearly glabrous to densely hirsute. Late July-early October.

Maine to Minnesota and Arizona and southward.

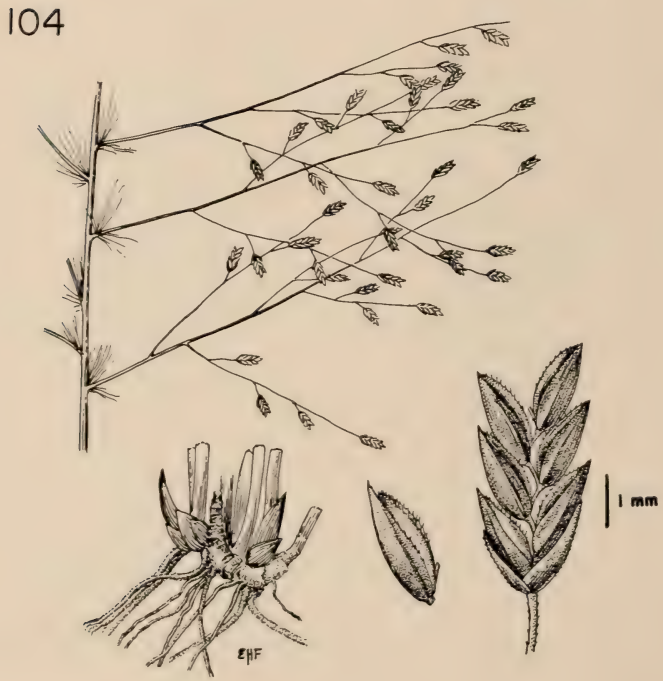
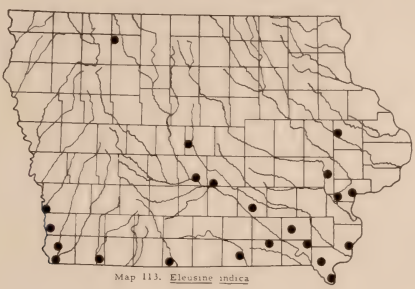


Figure 103. Eragrostis trichodes

Figure 104. Eragrostis spectabilis

42. ELEUSINE Gaertn.

Annual; tufted; culms erect or depressed and spreading, forming radiate patches; spikes several, digitate at the apex of the culm, or with others borne below; spikelets borne in two rows on the underside of a flattened rachis; spikelets several-flowered, compressed and keeled, disarticulating above the glumes and between the florets; lemmas 3-nerved.



Map 113. Eleusine indica

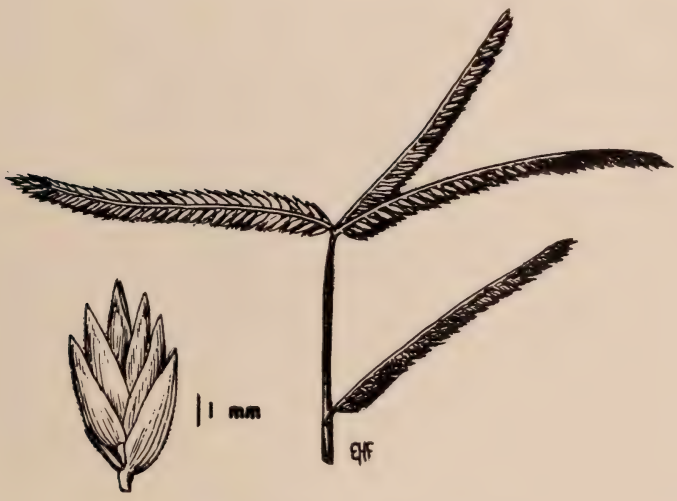


Figure 105. Eleusine indica

1. Eleusine indica (L.) Gaertn. Goosegrass Fig. 105; Map 113.

Goosegrass is a common weed in southern and central Iowa. It is found on cultivated fields, in gardens and on waste ground, often on paths. When trodden, the plants form dense sprawling mats. July-September.

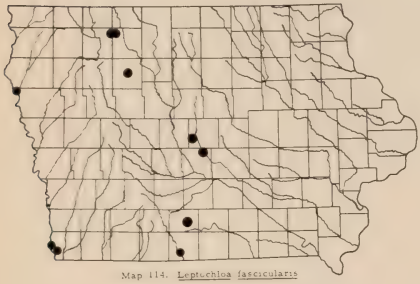
Introduced; probably native to the tropics of the Old World. The earliest dated record from Iowa is 1890. Massachusetts to Oregon and southward.

Chromosome number S=18 (Tateoka, 1954) Gould, 1960; 36 (De Lay, 1951).

43. LEPTOCHLOA Beauv.

Tufted annual; inflorescence a panicle of slender racemes; spikelets several-flowered, short-pedicellate, borne alternately in two rows on the two lower sides of the triangular rachis, placed with their first glumes toward the rachis; lemmas 3-nerved, bearing a short awn from a bifid apex, pubescent on nerves and callus in our species.

This genus has been placed in several tribes by different authors. Its chromosome numbers, spikelet and inflorescence structure suggest a close relationship to Eleusine and other members of the Eragrostoideae.



Map 114. Leptochloa fascicularis

Figure 106. Leptochloa fascicularis

Leptochloa fascicularis (Lam.) Gray. Fig. 106; Map 114.

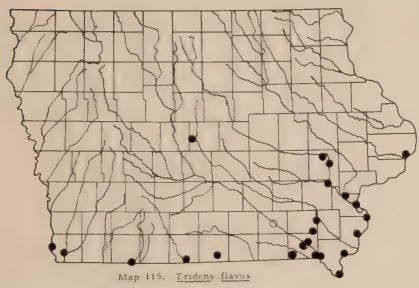
Diplachne fascicularis (Lam.) Beauv.

Wet ground, shores of lakes, occasional in northwestern Iowa; sandy alluvium along the Missouri River; Polk Co., Decatur and Clarke Counties. July-October.

Wet or alkaline places, through much of the United States and southward to Argentina. Variable in awn length and spikelet size.

44. TRIDENS Roem. and Schult.

Perennials, tufted; our species up to a meter or more tall, with an ample open panicle; spikelets with several florets; disarticulation above the lemmas and between the florets; lemmas with three conspicuous nerves which protrude from the apex of the lemmas as short points; lemmas rather blunt at the tip, usually lobed about the midnerve; nerves usually pubescent.



Map 115. Tridens flavus

Figure 107. Tridens flavus

Tridens flavus (L.) Hitch. Purpletop Fig. 107; Map 115.
Triodia flava (L.) Smyth

The plants form handsome clumps, quite leafy at the base. The panicles are up to 45 cm long, with drooping branches rather densely set with reddish purple spikelets. The plants will grow in partial shade. In Iowa, this species is restricted to the southern counties and is not common. In some localities it may become frequent along roadsides and in pastures, especially on sandy ground. It is apparently grazed by livestock. Chromosome number S=40 (Gould, 1958).

Purpletop ranges from New England to Nebraska and southward to the Gulf of Mexico. The specific name flavus means yellow, and refers to the fact that the type specimen known to Linnaeus had yellowish spikelets. August-September.

45. TRIPLASIS Beauv.

Spikelets with several florets, disarticulating above the glumes and between florets; lemmas blunt, 2-lobed, with three pubescent parallel nerves; midnerve protruding as a short point; palea pubescent along the keels on the upper half; an insignificant annual grass of sandy soils.

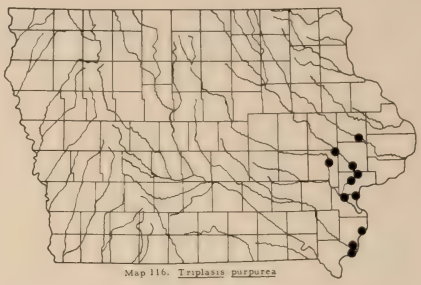


Figure 108. Triplasis purpurea

Triplasis purpurea (Walt.) Chapm. Purple Sandgrass Fig. 108; Map 116.

Occasional on sandy land in the southeastern counties. Late August and September.

The plants produce cleistogamous spikelets (cleistogenes) in the lower sheaths, which become swollen at their bases. The culms may later disarticulate at those nodes where cleistogenes are borne, thereby permitting the distribution of the seed.

Atlantic Coastal Plain from Maine to Texas; Central U.S. from Ohio to Minnesota to Colorado and Oklahoma.

46. CALAMOVILFA Hack.

Plants perennial, rhizomatous; herbage coarse and tough; inflorescence a usually contracted panicle; spikelets flattened; second glume about a third longer than the first, and slightly exceeding the floret; lemma bearing a copious tuft of straight ascending hairs on the callus; disarticulation above the glumes.

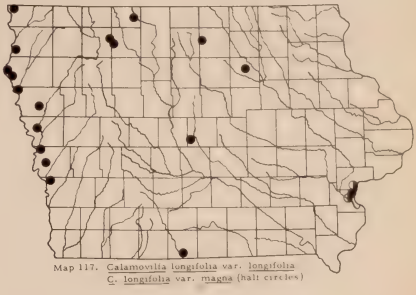

Map 117. Calamovilfa longifolia var. longifolia
C. longifolia var. magna (half circles)

Figure 109. Calamovilfa longifolia

Calamovilfa longifolia (Hook.) Scribn. var. longifolia Sand Reedgrass
Fig. 109; Map 117.

In Iowa, this species is largely restricted to the loess bluffs along the Missouri River and to the hills of the lake region of northwestern Iowa. The few scattered specimens from central Iowa, like the occurrence at Ames, are probably waifs brought in along railroads. The specimens collected on the sand plains along the Mississippi Valley have the open panicle characteristic of the populations of this species found around the Great Lakes (map; half circles). This extreme has been called var. magna Scribn. and Merr. Early July-September.

Chromosome number S= ca 60 (Reeder and Ellington, 1960).

Michigan and Indiana westward to Alberta, Idaho and Colorado.

47. MUHLENBERGIA Schreb. Muhly Grass

Plants perennial, rhizomatous or tufted; rhizomes usually densely covered with overlapping scales; inflorescence an open or contracted panicle; spikelets one-flowered, disarticulating above the glumes; lemma papery, keeled, awned or awnless, 3-nerved, longer than the glumes except in a few species with awned glumes; caryopsis free from the lemma and palea but usually retained between them. The genus was named for the Rev. G.H.E. Muhlenberg, an early American student of grasses. The generic common name is apparently a corruption of the scientific name.

Literature

Fernald, M.L. 1943. Five common rhizomatous species of Muhlenbergia. Rhodora 45:221-239.

1. Glumes awn-tipped, both exceeding the awnless lemma in length.
   2. Ligule more than 0.5 mm long; internodes glabrous and shining except near the apex; anthers 0.4-0.8 (-1.0) mm long; lemma hairy only at the base; plants of dry ground, usually bushy-branched from the middle nodes . . . . . 1. M. racemosa
   2. Ligule 0.5 mm long or shorter; internodes puberulent, dull; anthers 0.8-1.5 mm long; lemma hairy at base and along the margins; plants of bogs and marshes, rarely branched . . . . . 2. M. glomerata
1. Glumes usually awnless, shorter than or rarely equalling the awned or awnless lemma
   3. Glumes minute, less than 1/10 as long as the lemma; rhizomes absent . . . . . 3. M. schreberi
   3. Glumes at least 1/2 as long as the lemma; rhizomes present or absent
      4. Plants tufted, from a knotty crown; rhizomes lacking; spikelets awnless . . . . . 4. M. cuspidata
      4. Plants rhizomatous, the rhizomes elongated, covered with scales; spikelets awned or awnless
         5. Panicles open, dome-shaped, the minute spikelets on elongated slender pedicels; leaves 1-2 mm wide . . . . . 5. M. asperifolia
         5. Panicles slender or densely congested, the pedicels not spreading; larger leaf blades 3-10 mm wide.
            6. Internodes smooth and shining, especially below the middle

7. Culms with terminal and partly included axillary panicles; spikelets awned or awnless

8. Glumes shorter than the floret; ligules usually less than 0.5 mm long. . . . . 6. M. brachyphylla

8. Glumes usually as long as the floret; ligules 1-1.2 mm long. . . . . 7. M. frondosa

7. Terminal and axillary panicles on slender, elongated peduncles; spikelets awnless. . . . . 9. M. sobolifera

6. Internodes dull, short-puberulent especially toward the apex.

9. Glumes shorter than the floret, abruptly tapered to a point, 1-3 nerved; sheaths retrorsely puberulent; anthers 1.2-1.5 mm long. . . . . 8. M. tenuiflora

9. Glumes equalling the floret, tapering gradually to the apex, 1-nerved; sheaths glabrous; anthers 0.7 mm long or shorter

10. Inflorescence dense, the spikelets subsessile; ligule 1 mm or less long; spikelets awnless or awned 10. M. mexicana

10. Inflorescence slender, at least some of the spikelets on pedicels as long as the spikelets; ligules 1.2-2 mm long; spikelets awned. . . . . 11. M. sylvatica

1. Muhlenbergia racemosa (Michx.) B.S.P. Fig. 110; Map 118.

Perennial; rhizomatous. Common throughout Iowa on dry prairies, loess bluffs, margins of fields and waste ground.

This species and the next are superficially similar and have been merged by some authors. While some of the key characters occasionally fail, the two are sharply different in their habitat preferences, chromosome numbers, and branching pattern. M. racemosa is usually bushy-branched from the middle nodes, while M. glomerata has simple culms.

Chromosome number S=40 (Pohl and Mitchell, 1965).

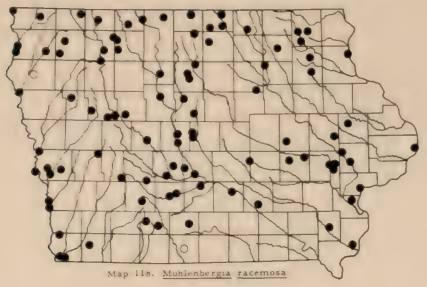
Michigan to Oklahoma, westward to Alberta and Arizona.

2. Muhlenbergia glomerata (Willd.) Trin. Fig. 111; Map 119.

Perennial; rhizomatous. Rare in Iowa; fens, marshes and peat bogs in central and northern Iowa. This species has most frequently been found in the renowned Silver Lake Fen in Dickinson County. August-September.

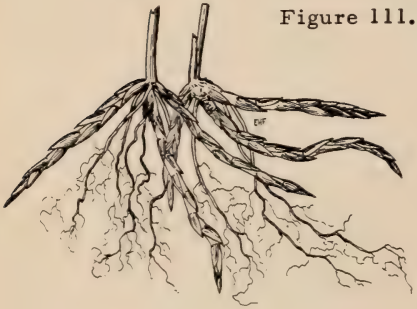
Chromosome number S=20 (Pohl and Mitchell, 1965).

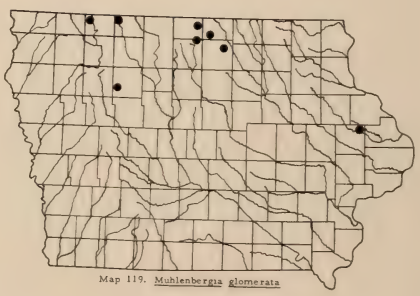
Boreal America, south to Virginia, Indiana, Iowa and Nebraska.



Map 118. Muhlenbergia racemosa

Figure 111. M. glomerata





Map 119. Muhlenbergia glomerata

Figure 110. Muhlenbergia racemosa

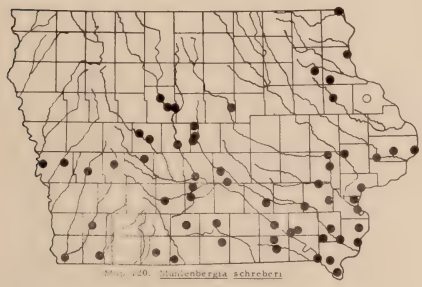
3. Muhlenbergia schreberi Gmel. Nimblewill Fig. 112; Map 120.

Perennial; culms erect in early season, later sprawling and rooting at the lower nodes; true rhizomes not produced.

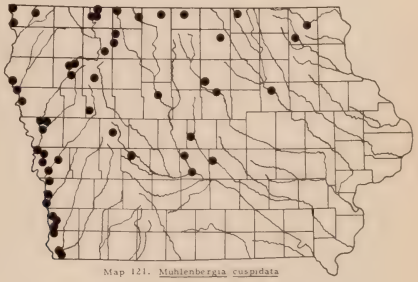
Nimblewill is a common but not particularly aggressive weed, found occasionally in shady lawns and in shrubbery. Its natural habitat is in open woodlands and on stream bottomlands. It is found widely dispersed in Iowa but is absent from the northwestern one-third of the state. July-October.

Chromosome number S=40 (Pohl and Mitchell, 1965).

New England to Florida, westward to Wisconsin, Nebraska, Texas, and eastern Mexico.



Map 120. Muhlenbergia schreberi



Map 121. Muhlenbergia cuspidata

4. Muhlenbergia cuspidata (Torr.) Rydb. Fig. 113; Map 121.

Sporolobus cuspidatus (Torr.) Wood

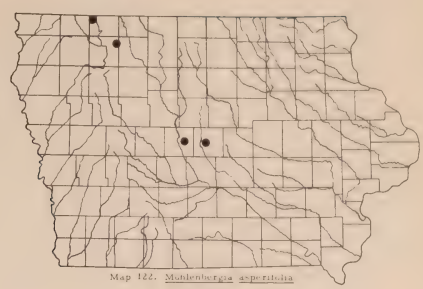
Tufted; culms arising from knotty crowns, with numerous hard, short winter buds at the base. Dry gravelly prairie hills and loess bluffs; usually associated with short-grasses such as the species of grama grass; common in the northwestern half of the state. Late July-September.

The caryopses of this species are sometimes attacked by an insect and form smooth spherical yellow galls, 1-1.5 mm in diameter, with a pointed beak at the stylar end.

Ohio and Kentucky to Alberta and New Mexico.

Figure 112. Muhlenbergia schreberi

Figure 113. M. cuspidata



Map 122. Muhlenbergia asperifolia

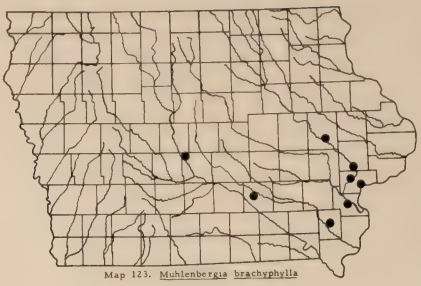
Figure 114. Muhlenbergia asperifolia

5. Muhlenbergia asperifolia (Nees and Mey.) Parodi. Scratchgrass
Fig. 114; Map 122.

Perennial; extensively rhizomatous. Fens and lake shores, Clay and Dickinson Counties; also introduced along the tracks of the C. & N. W. R. R. in Boone and Story Counties. August-September.

Chromosome number S=20 (Myers, 1947; Pohl and Mitchell, 1965).

Indiana to the Dakotas and Alberta, southward to Texas and Mexico; temperate South America.



Map 123. Muhlenbergia brachyphylla

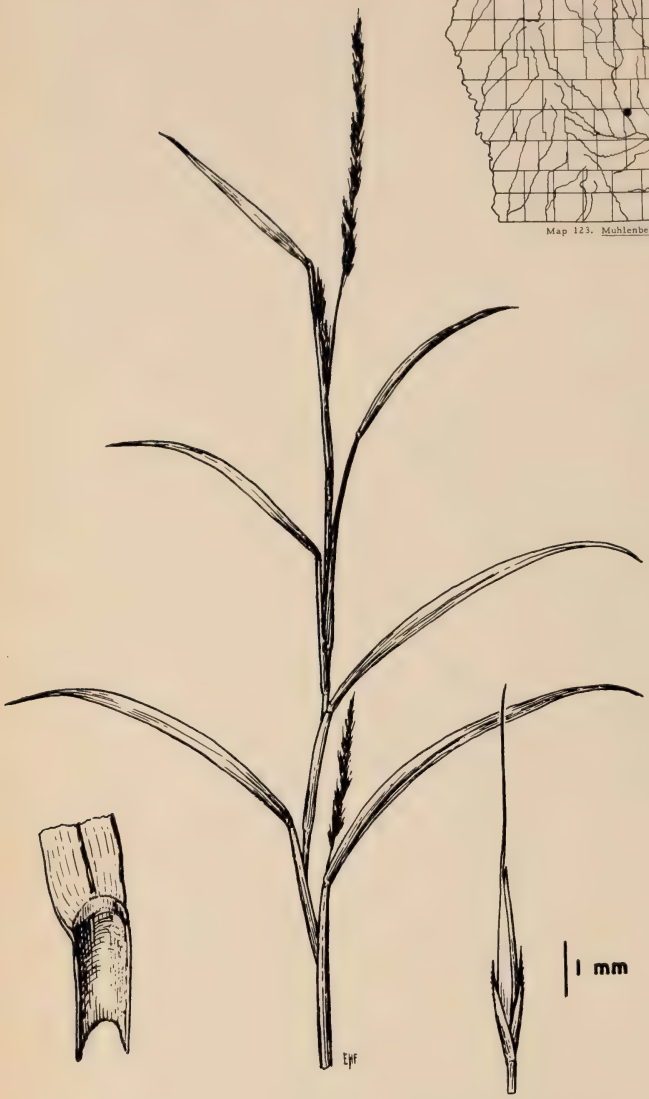
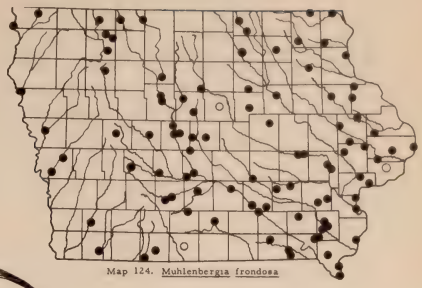


Figure 115. Muhlenbergia brachyphylla

6. Muhlenbergia brachyphylla Bush. Fig. 115; Map 123.
Probably widely distributed in wooded areas, southern Iowa.
Chromosome number S=40 (Pohl and Mitchell, 1965).
Indiana and Wisconsin to Nebraska and Texas; Maryland to North Carolina.



Map 124. Muhlenbergia frondosa

Figure 116. Muhlenbergia frondosa

7. Muhlenbergia frondosa (Poir.) Fern., f. frondosa Fig. 116; Map 124.
M. mexicana of American authors, not Agrostis mexicana L.

Perennial; rhizomatous. Very common and widespread in Iowa; producing panicles from many of the upper leaf axils and becoming bushy and sprawling or scrambling through shrubs. The plants are variable in the density of the panicle, those growing in shade being apparently more slender and delicate. Large, leafy cigar-shaped galls are sometimes borne at some of the nodes, a phenomenon common in other species as well. Plants which are injured or cut back may produce dense masses of erect branches and numerous panicles.

Waste ground, roadsides, shrubbery and open woods. The plants are weedy and sometimes will persist for a time in cultivated fields, especially on low ground. August-September.

Forma commutata (Scribn.) Fernald has lemmas bearing delicate awns. It may rarely be found in the range of typical M. frondosa.

Chromosome number S=40 (Pohl and Mitchell, 1965).

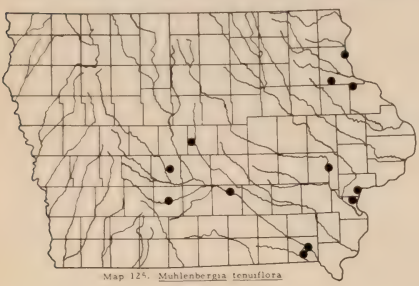
New Brunswick to Georgia, westward to North Dakota and Texas.

8. Muhlenbergia tenuiflora (Willd.) B.S.P. Fig. 117; Map 125.
M. willdenovii Trin.

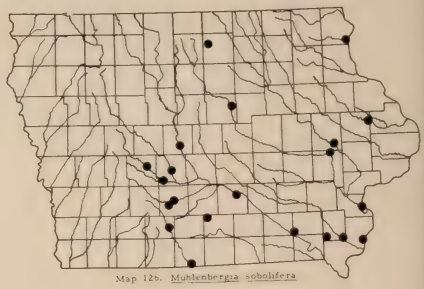
Perennial; rhizomatous. Occasional in rich woods in eastern and southern Iowa. July-September.

Chromosome number S=40 (Pohl and Mitchell, 1965).

New England to Georgia, westward to Wisconsin, Iowa and Oklahoma.



Map 125. Muhlenbergia tenuiflora



Map 126. Muhlenbergia sobolifera

Figure 117. Muhlenbergia tenuiflora Figure 118. M. sobolifera

9. Muhlenbergia sobolifera (Muhl.) Trin. Fig. 118; Map 126.

Perennial; rhizomatous; rare or occasional in rich woods in the eastern two-thirds of Iowa. August-September.

Chromosome number S=40 (Pohl and Mitchell, 1965).

New Hampshire to Virginia and Texas, westward to Wisconsin and Nebraska.

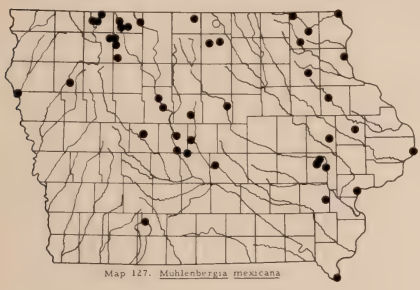
10. Muhlenbergia mexicana (L.) Trin. f. mexicana Fig. 119; Map 127.
M. foliosa of American authors.

Perennial; rhizomatous. Fairly common in moist ditches, low woods, margins of lakes, low prairies, peat bogs; northern and eastern Iowa. August-September.

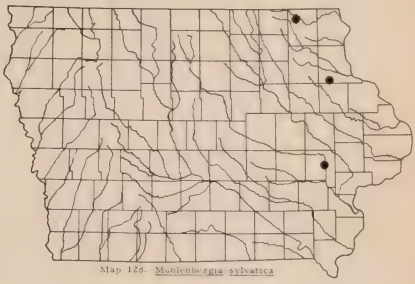
Forma ambigua (Torr.) Fernald has awned lemmas.

Chromosome number S=40 (Pohl and Mitchell, 1965).

Quebec to North Carolina, westward to British Columbia, Arkansas, Arizona and California.



Map 127. Muhlenbergia mexicana



Map 128. Muhlenbergia sylvatica

Figure 119. Muhlenbergia mexicana Figure 120. M. sylvatica

11. Muhlenbergia sylvatica (Torr.) Torr. Fig. 120; Map 128.
M. umbrosa Scribn.

Deciduous forests; rare, eastern Iowa. August-September.

Chromosome number S=40 (Avdulov, 1931; Pohl and Mitchell, 1965).

Quebec to North Carolina and Georgia, westward to Minnesota, South Dakota and Texas.

48. SPOROBOLUS R. Br. Dropseed

Tufted annuals or perennials; inflorescence paniculate, often slender and partly included in the upper sheath; spikelets one-flowered, disarticulating above the glumes; lemma awnless, 1-nerved; palea often longer than the lemma; caryopsis freely dropping from the floret; pericarp (except in S. heterolepis) thin, gelatinizing when wet and slipping from the seed.

Key to Species

1. Lemmas pubescent

   2. Terminal panicles exserted, 3-10 cm long; plants perennial, mostly 50-90 cm tall; culms with hard bases which at flowering time bear numerous short, scaly buds . . . 3. S. clandestinus

   2. Terminal panicles mostly included, or if exserted, then slender, few-flowered, 1-3 cm long; plants shallow-rooted annuals, tufted, lacking scaly buds at flowering time 1. S. vaginiflorus

1. Lemmas glabrous

   3. Glumes subequal, about as long as the floret 2. S. neglectus

   3. Glumes markedly unequal in length

      4. Spikelets 4-7 mm long.

         5. Panicle open, exserted; second glume exceeding the floret; caryopsis at maturity spherical, bursting from the lemma and palea. . . . . 6. S. heterolepis

         5. Panicle spikelike, usually partly or wholly included in the upper sheath; second glume shorter than the floret; caryopsis not spherical nor bursting from the floret . . . . . 4. S. asper

      4. Spikelets 1.4-3 mm long; sheaths bearing conspicuous tufts of white hairs at the throat. . . . . 5. S. cryptandrus

1. Sporobolus vaginiflorus (Torr.) Wood. Fig. 121A; Map 129.

These diminutive annual grasses are commonly found on dry, sterile soils throughout Iowa. They are not often collected, probably because of their small size and late-blooming, in August and September.

Chromosome number S=54 (Gould, 1960).

Maine to Georgia, westward to Minnesota and Texas; Arizona and New Mexico.

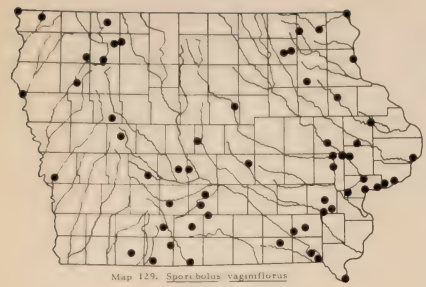
Shinners (1954) has combined this species and the next, stating that they intergrade in Texas. The two species are easily separable on the basis of lemma pubescence, and this distinction is supported, among our Iowa specimens, by the following size differences:

	S. neglectus	S. vaginiflorus
Length of spikelet	2.0-3.6 mm (mode at 2.4-2.6 mm)	3.6-8.0 mm (mode at 6.0 mm)
Length of lemma	2.0-3.2 mm (mode at 2.4 mm)	3.2-6.4 mm (mode at 5.2 mm)
Length of palea	2.0-3.6 mm (mode at 2.4 mm)	3.6-8.0 mm (mode at 5.6 mm)
Lemma Length / width	2.4-4.4 (mode at 3.2)	4.8-8.0 (mode at 7.2)

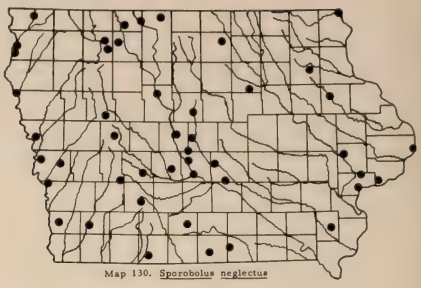
Fernald (1933) established S. vaginiflorus var. inaequalis Fernald which is said to have paleas much prolonged beyond the lemma and glumes. In Iowa material, we find a continuous linear variation in the ratio of palea length to lemma length, the shortest florets having a ratio, palea:lemma::3.3:2.9 and the longest, 7.8:6.2. There is no suggestion of a separable "var. inaequalis."

Maine to Georgia, westward to Ontario, Texas, and Arizona.

Figure 121. A. Sporobolus vaginiflorus; B. Sporobolus neglectus



Map 129. Sporobolus vaginiflorus



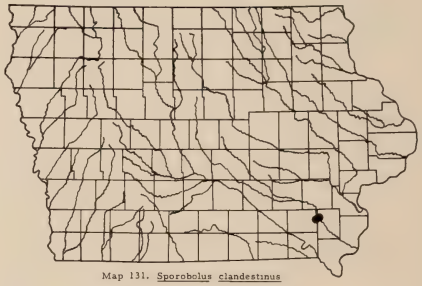
Map 130. Sporobolus neglectus

2. Sporobolus neglectus Nash. Fig. 121B; Map 130.

Annual; widespread on dry, sterile soils in lawns, pastures, and waste ground in Iowa. Probably this species, like the last, is much more common than our records indicate. August-October.

Chromosome number S=36 (Brown, 1950).

Quebec to Virginia and Louisiana, westward to the Dakotas, Colorado and Texas; Washington and Arizona.



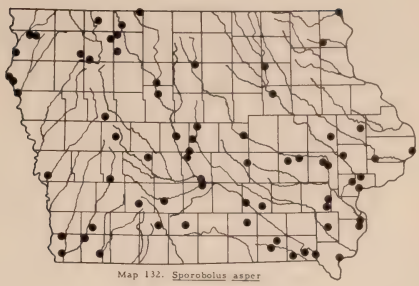
Map 131. Sporobolus clandestinus

Figure 122. Sporobolus clandestinus

3. Sporobolus clandestinus (Biehler) Hitch. Fig. 122; Map 131.

Perennial; rare in Iowa, known to us only by the following collections: Henry Co.: NW$\frac{1}{4}$ Sec. 18, T 72 N., R 7 W. Prairie on sand ridge. M. McDonald (ISC). Jefferson Co.: NE$\frac{1}{4}$ Sec. 12, Lockridge Twp. Open prairie on sand ridge. M. McDonald (ISC).

Connecticut to Florida, westward to Wisconsin, Iowa, Kansas and Texas.



Map 132. Sporobolus asper

Figure 123. Sporobolus asper

4. Sporobolus asper (Michx.) Kunth. Fig. 123; Map 132.

Perennial; common on dry prairie slopes and gravelly hills in Iowa. The panicles are commonly partially hidden in the upper sheath. One Iowa specimen from Dickinson County has pubescent leaves. In var. hookeri (Trin.) Vasey, the slender panicles are exserted and the spikelets are slightly smaller than in typical S. asper (under 5 mm long). This variety has occasionally been found on dry, morainic hills. August-October. Chromosome number S=54 (Brown, 1950).

Vermont to Virginia and Louisiana, westward to Washington and Arizona.

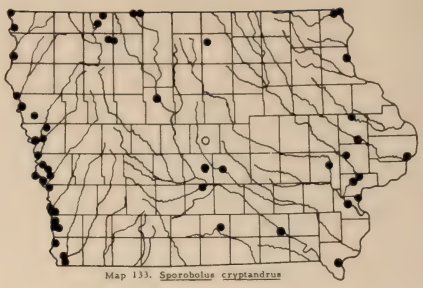

Map 133. Sporobolus cryptandrus

Figure 124. Sporobolus cryptandrus

5. Sporobolus cryptandrus (Torr.) A. Gray Sand Dropseed
Fig. 124; Map 133.

Perennial; scattered in Iowa and most frequently found along the eastern and western borders. Sandy prairies, lake shores, loess bluffs. August-September. Chromosome number S=36 (Bowden, 1960B).

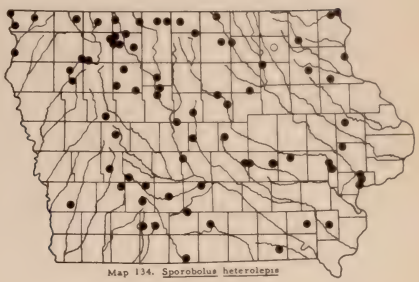
Two geographic races of this species exist in Iowa, which may be separated on the following bases:

1. Spikelets 1.4-2.0 mm long; panicle dense, usually partly included in the upper sheath. . . . . 5A. Var. cryptandrus

1. Spikelets 2.0-3.0 mm long; panicle generally exserted, with spreading branches. . . . . 5B. Var. fuscicolor

5B. S. cryptandrus var. fuscicolor (Hook.) Pohl, Stat. nov.
(Vilfa tenacissima β fuscicolor Hook., Fl. Bor. Am. 2:239 (1839).
Sporobolus cryptandrus ssp. fuscicolus Jones and Fassett, Rhodora 52:126 (1950).

Quebec and Massachusetts to western Washington, southward to Missouri, Colorado, and the Northern Plains states.



Map 134. Sporobolus heterolepis

Figure 125. Sporobolus heterolepis

6. Sporobolus heterolepis (A. Gray) A. Gray Prairie Dropseed
Fig. 125; Map 134.

Perennial; often in large circular clumps. Common on prairies in most of Iowa but apparently absent from the loess soil areas of the western counties.

In this species, the caryopsis becomes rigid, shining, and yellowish at maturity, assuming a spherical shape, about 2 mm in diameter. August-September. Chromosome number S=72 (Nielsen, 1939).

Quebec and Connecticut to Saskatchewan, Colorado and Texas.

49. HELEOCHLOA Host ex Roemer

Spreading annuals; panicles dense and spikelike, included at the base in the uppermost sheath; spikelets with a single floret, disarticulating above the glumes; glumes and lemma 1-nerved; caryopsis free, readily extruded from the floret and clinging to the panicle; pericarp gelatinizing when wet, separating from the seed.

1. Heleochloa schoenoides (L.) Host Fig. 126 Map 135.

Tufted annual; culms erect, or spreading and the plants forming flat mats; culms much branched, bearing terminal and numerous axillary panicles. The panicles resemble miniature timothy inflorescences.

This species is a rare adventive in the United States, being introduced from Europe. It ranges from the Middle Atlantic States to Wisconsin and Iowa; California. The single Iowa specimen is cited below.

Polk Co.: N. of Rock Island R. R. tracks, between 6th and 7th Sts., Des Moines. Oct. 5, 1937. Ada Hayden 4073 (ISC).

Chromosome number S=36 (Avdulov, 1931).

TRIBE 16. CHLORIDEAE

50. CYNODON L. C. Rich. Bermuda Grass

Stoloniferous and rhizomatous perennial; culms low, terminating in an inflorescence of several digitate slender spikes; spikelets in two rows along the lower side of the rachis, single-flowered, laterally compressed, disarticulating above the glumes; rachilla prolonged behind the palea as a naked bristle.

Cynodon dactylon (L.) Pers. Bermuda Grass

Bermuda grass, an important lawn and forage grass in the South, is not reliably hardy in Iowa, although it may flourish for a time in protected spots. It has been grown experimentally in Ames several times, and there are unconfirmed reports of wild occurrences in southern Iowa. Our few specimens are mostly very old, and probably from cultivated stands. The species should be looked for in southern Iowa.

Cynodon transvaalensis Burt-Davey was reported by Chase (1950) from Ames. The specimen, collected by Jess Fults, was from the railroad tracks. No recent collections have been made.

51. SCHEDONNARDUS Steud.

Tufted perennial; inflorescence a skeleton-like open panicle of slender spikes; spikelets distant, appressed in two rows along the lower side of the triangular rachis; spikelets with a single floret, disarticulating above the glumes. The mature panicles have a somewhat spiral rachis. The panicles disarticulate from the plant and tumble with the wind.

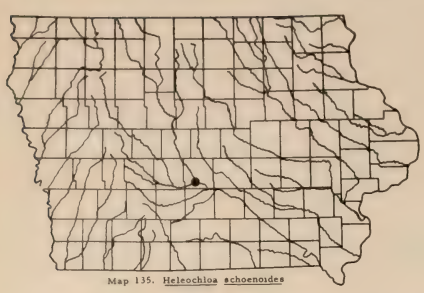
1. Schedonnardus paniculatus (Nutt.) Trel. Tumblegrass

Fig. 127; Map 136.

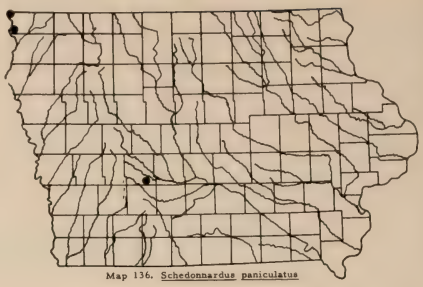
This species is common on the Great Plains, but is a rare adventive

Figure 126. Heleochloa schoenoides

Figure 127. Schedonnardus paniculatus



Map 135. Heleochloa schoenoides



Map 136. Schedonnardus paniculatus

on dry soils in western Iowa. It has been found a number of times at Gitchie Manitou State Park, and will probably be found in other localities in western Iowa. All known stations for this species in Iowa are cited below.

Guthrie Co.: Barren hilltop, Menlo. J.R. Miller. 1928 (ISC); Lyon Co.: Gitchie Manitou State Park, growing in soil of the crevices on Sioux Quartzite rock. Ada Hayden 9146 (ISC); R 48W, T 98N, Sec. 22, plants several, around hardpan spot or "buffalo wallow," R. L. McDill 187 (ISC).

52. CHLORIS Swartz

Inflorescence of several to many one-sided spikes; spikelets in two rows on the lower side of the rachis; disarticulation above the glumes; fertile floret single, falling with the one to several rudimentary florets attached.

Chloris verticillata Nutt. Windmill Grass Fig. 128; Map 137.

Plants perennial; spreading by short stolons; herbage pale green. sheaths keeled; inflorescence of one to several whorls of slender spikes.

This species is adventive from the southern Great Plains and has been found only in Polk, Warren, Lee and Story counties in Iowa. In the Ames locality it has persisted for at least eighteen years, and is now spreading out of the protected spot it formerly occupied. Late summer.

Indiana and Iowa to Colorado, southward to Louisiana and Arizona.

Chromosome number S=80 (Brown, 1950).

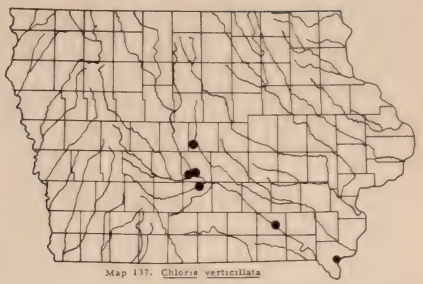
53. BOUTELOUA Lag.

Inflorescence of one to many one-sided spikes, the spikelets borne in two rows along the lower side of the rachis; disarticulation above the glumes, or entire spikes dropping from the rachis; spikelets bearing a single perfect floret with one or more awned rudiments above it. Our species are perennials.

Key to Species

1. Inflorescence of 20 or more short spikes, racemosely arranged on a slender rachis; spikes drooping, falling from the rachis when mature. . . . . 1. B. curtipendula

1. Inflorescence of 1-3 spikes; disarticulation above the persistent glumes



Map 137. Chloris verticillata

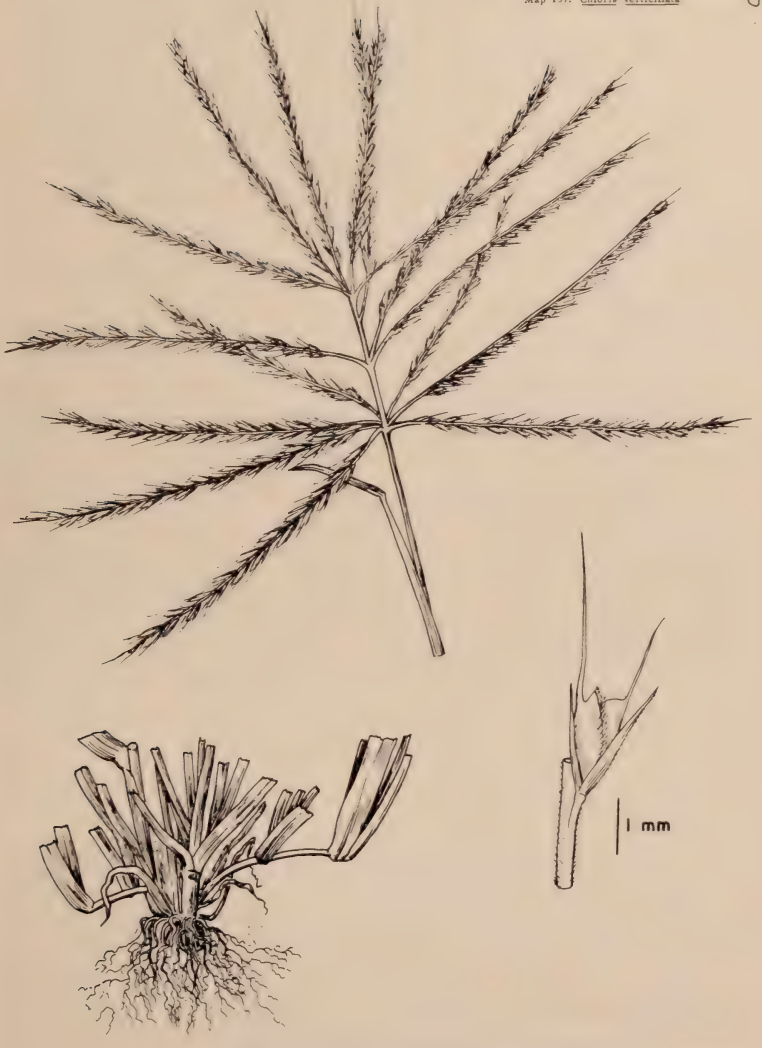


Figure 128. Chloris verticillata

2. Axis of the spike extending beyond the spikelets as a naked point; keel of second glume bearing hairs which arise from black tubercles . . . . . 2. B. hirsuta

2. Axis of spikes bearing spikelets to the tip; glumes lacking black tubercles. . . . . 3. B. gracilis

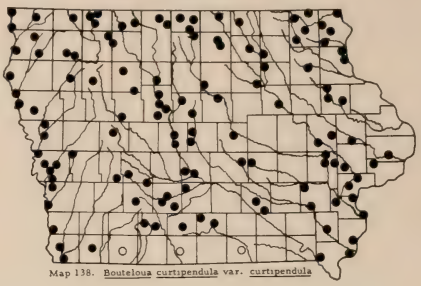

Map 138. Bouteloua curtipendula var. curtipendula

Figure 129. Bouteloua curtipendula

1. Bouteloua curtipendula (Michx.) Torr. var. curtipendula
Side-oats Grama. Fig. 129; Map 138.

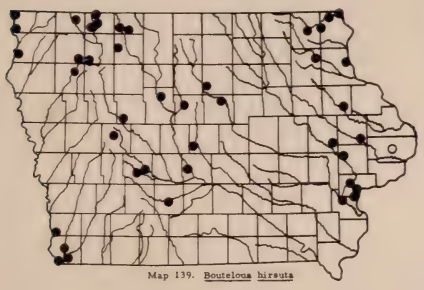
Slender erect perennial, the tufts arising from slender rhizomes. Side-oats is common and widely distributed in Iowa. It is most prevalent on drier sites, such as upland prairies, sparsely wooded hills, and loess bluffs. Late June-October. Chromosome number S=40; other numbers are known from other varieties in the South (Gould and Kapadia, 1962, 1964).

This species is common through the Great Plains and Rocky Mountain states and extends eastward in favorable sites to Maine, South Carolina, and Alabama.

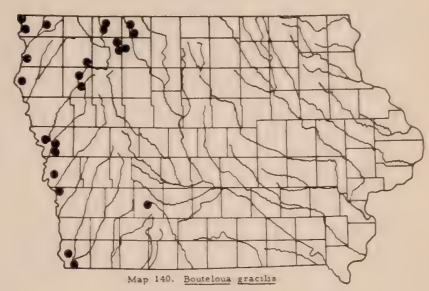
2. Bouteloua hirsuta Lag. Hairy Grama Fig. 130; Map 139.

Tufted. Dry gravelly or sandy soils, on prairie hilltops and loess bluffs; sand plains and dunes. This species is apparently less common in Iowa than the previous one. July-October. Chromosome numbers S=21, 37, 42 (Fults, 1942); 28 (Brown, 1951).

Wisconsin to Louisiana, westward to North Dakota, California and Mexico; Florida.



Map 139. Bouteloua hirsuta



Map 140. Bouteloua gracilis

3. Bouteloua gracilis (H. B. K.) Lag. ex Steud. Blue Grama Fig. 131; Map 140.

Tufted. Dry gravelly hilltops, loess bluffs; western Iowa. Late June-September. This is one of the most valuable western forage species, but in Iowa it is of too rare occurrence to be important. Chromosome numbers S=21, 28, 35, 42, 61, 77 (Fults, 1942).

Alberta and southern California, eastward to Wisconsin and Arkansas; occasionally found as an introduction in the eastern states.

54. BUCHLOË Engelm.

Dwarf stoloniferous perennial; dioecious; staminate inflorescence of one to several short, one-sided spikes; staminate spikelets 2-flowered, in 2 rows along the lower side of the rachis; pistillate inflorescences partially concealed by the upper leaf sheaths; each spike reduced to a bead-like structure, its outer covering made up of the indurated second glumes of several spikelets. The glumes have greenish herbaceous tips. The pistillate inflorescences are shed from the plants as units, the grains being retained within the "bead."

Buchloë dactyloides (Nutt.) Engelm. Buffalo Grass Fig. 132; Map 141.

This characteristic species of the Great Plains is rare in Iowa, and except for the population in Gitchie Manitou State Park, our records probably represent accidental or deliberate introductions from farther west.

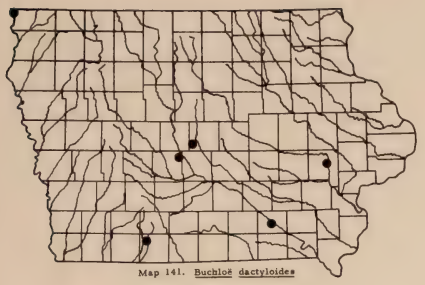
Because of its extreme drouth resistance, low growth, and stoloniferous habit, this species might be valuable for revegetation of dry sterile banks and slopes, where ordinary lawn grasses fail.

Dry plains, western Minnesota and Montana, southward to western Louisiana and Arizona.

Chromosome number S=60 (Avdulov, 1931); 56 (Nielsen, 1939).

Figure 130. Bouteloua hirsuta

Figure 131. Bouteloua gracilis



Map 141. Buchloë dactyloides

Figure 132. Buchloë dactyloides

TRIBE 17. SPARTINEAE

55. SPARTINA Schreb. Sloughgrass

Plants perennial, rhizomatous; inflorescence of several to many dense, one-sided spikes; spikelets sessile in two rows on two sides of the triangular rachis; spikelets 1-flowered, compressed and keeled, disarticulating below the glumes.

Spartina pectinata Link. Sloughgrass Fig. 133; Map 142.

Prairies, especially on low or swampy ground; very common and widespread in the original prairie in Iowa, now mostly confined to roadsides and relict prairies. Late June-October.

Sloughgrass was one of the principal grasses of the tall grass prairie, and may still furnish forage in a few localities in Iowa.

The plants vary greatly in size and in the appearance of the inflorescence. Several varieties have been proposed upon the basis of inflorescence characters. The inflorescence varies in the number of spikes, their length to width ratio, and the number of spikelets per unit of length of each spike. The studies of Mobberley (1953) have shown that no definitely separable varieties can be delimited.

Like the other species of the genus, Spartina pectinata apparently reproduces almost entirely by rhizomes. Seed is very rarely produced. Since the plants are extremely long-lived perennials, random variations occurring among plants produced occasionally from seed may be preserved almost indefinitely.

Chromosome numbers within this species vary greatly. Mobberley (1956) reported somatic numbers of S=42 from central Iowa and S=70 from the western border of the state. Church (1940) reported a specimen from Nebraska as having S=84, as well as another from Massachusetts with S=42.

TRIBE 18. AELUROPIDEAE

56. DISTICHLIS Raf. Saltgrass

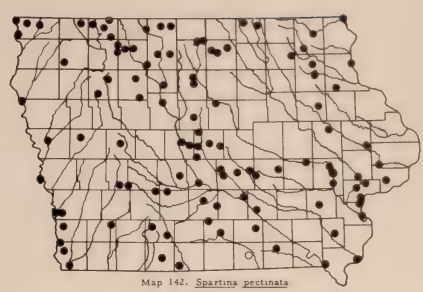
Plants perennial, rhizomatous; dioecious, both sexes with similar spikelets; inflorescence a contracted simple panicle of a few spikelets; spikelets with several-many florets, compressed and keeled, disarticulating above the glumes and between the florets; lemmas glabrous, lustrous, stiff, with numerous inconspicuous nerves.

Distichlis stricta (Torr.) Rydb. Fig. 134; Map 143.

This species occurs mostly on saline or alkali soils in the West. Our few collections, listed below, probably represent introductions in recent time from farther west. June-July.

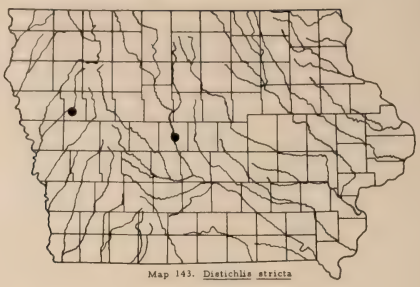
Chromosome number S=40 (Stebbins and Love, 1941; Bowden, 1960A).

Boone Co.: 3 mi. e. of Boone, along the edge of railroad track. June 28, 1935, McElhinney 6-12 (ISC); same locality, July 3, 1935, W. L. Tolstead (ISC). Ida Co.: Battle Creek. June 1, 1932, J.S. Crawford (ISC).



Map 142. Spartina pectinata

Figure 133. Spartina pectinata



Map 143. Distichlis stricta

Figure 134. Distichlis stricta

SUBFAMILY PANICOIDEAE

TRIBE 19. PANICEAE

57. PANICUM L.

Plants annual or perennial, tufted or rhizomatous; inflorescence an open or contracted panicle; spikelets with first glume half or less the length of the spikelet; second glume and sterile lemma equal, membranaceous, concealing the fertile floret; fertile floret rigid, the edges of lemma inrolled and covering the edges of the palea.

Our species fall into two subgenera. The first, Panicum, contains plants with a single blooming period and mostly open-pollinated flowers.

The second, Dichanthelium, contains the majority of the American species. In this group two blooming periods occur. As the culms develop in spring, they produce terminal panicles which usually bloom in May to early July. Later the culms branch, usually from the middle nodes, and produce small axillary panicles. The old terminal panicles may fall away, and the plants become bushy or mat-like from the profuse development of branches. While it is often stated that the primary panicles are open pollinated and sterile, and the small axillary panicles are cleistogamous and fertile, observation indicates that this is not necessarily true. Most of the species produce winter rosettes of short, broad leaves, often very different in size, indument, and texture from the culm leaves.

Key to Species

1. Plants having a single blooming period, the terminal and axillary panicles simultaneous; annuals or perennials, without basal rosettes of short leaves; spikelets glabrous (Subgenus Panicum)

2. Plants tufted, annual

3. Sheaths glabrous; first glume very short, blunt . . . . . 1. P. dichotomiflorum

3. Sheaths papillose-hispid; first glume acute or acuminate

4. Spikelets 4.5 mm or more long, on stout drooping branches; fertile lemma straw-colored, reddish, or brown . . . . . 7. P. miliaceum

4. Spikelets less than 4 mm long; panicle branches slender, stiff, fertile lemma straw-colored

5. Fertile floret with a prominent lunate scar at the base. . . . . 6. P. hillmanii

5. Fertile floret without a prominent lunate scar

6. Spikelets slender-acuminate; second glume and sterile lemma with definite prolonged tips

7. Terminal panicle narrowly ellipsoid, usually not more than 1/3 the height of the plant; plants slender, usually 2.5-4 dm tall; pulvini of lower branches glabrous . . . . . 2. P. flexile

7. Terminal panicle ample, broadly ovoid, many-flowered, as much as 1/2 the height of the plant or more; plants coarse, usually 4-10 dm tall; pulvini of lower panicle branches hispid 5. P. capillare

6. Spikelets acute or rarely short-cuspidate, never slender-acuminate; terminal panicle usually not over 1/3 the height of the plant

8. Plants large, coarse, usually 3.5-5.5 dm tall; larger leaf blades 5-11 mm wide, usually 10-20 cm long; panicles ellipsoid, not diffuse; spikelets appressed, sub-racemose along the panicle branches; pulvini of main panicle branches glabrous. . . . . 3. P. gattingeri

8. Plants small, delicate, usually 1.5-4 dm tall; culms slender; leaf blades usually 2-5 mm wide, 4-9 cm long; panicles ovoid, rather diffuse; spikelets tending to be clustered in twos or threes at the ends of the panicle branches; pulvini of main panicle branches usually hispid. 4. P. philadelphicum

2. Plants rhizomatous, perennial. . . . . 8. P. virgatum

1. Plants having two blooming periods, the terminal panicles produced in spring or early summer, the plants later branching and producing small axillary panicles; plants perennial, usually producing winter rosettes of short, broad leaves; spikelets pubescent in our species (Subgenus Dichanthelium).

9. Secondary panicles borne near the base of the plants; no branching from middle or upper nodes; leaf blades 20 or more times longer than wide.

10. Spikelets 3.2-4 mm long, the second glume and sterile lemma protruding as a flattened beak beyond the fertile floret. . . . . 9. P. depauperatum

10. Spikelets 2.2-3.2 mm long, the spikelets not prolonged beyond the fertile floret.

11. Pedicels of lateral spikelets on each panicle branch shorter than the spikelets; spikelets 2.8-3.2 mm long. . . . . 11. P. perlongum

11. Pedicels of lateral spikelets usually longer than the spikelets; spikelets 2.2-2.8 mm long. 10. P. linearifolium

9. Secondary panicles borne at middle and upper nodes of culms; leaf blades usually less than 15 times longer than broad.

12. Ligules 2-6 mm long; sheaths papillose-hirsute.

13. At least the upper sheaths glabrous; secondary branches of culms forming dense, strict fascicles. 12. P. lindheimeri

13. Sheaths all more or less pubescent; secondary branches not in dense fascicles.

14. Spikelets 1.3-1.7 mm long; hairs of middle sheaths less than 2 mm long. . . . . 13. P. implicatum

14. Spikelets 1.7-2.2 mm long; hairs of middle sheaths 3-6 mm long. . . . . 14. P. praecocius

12. Ligules usually less than 2 mm long; sheaths variously pubescent or nearly glabrous.

15. Leaf blades 1-3 cm wide, with a cordate base; sheaths of main culm leaves not bristly.

16. Spikelets 2.7-3 mm long; sheaths of secondary branches papillose-bristly, the secondary panicles mostly concealed in the sheaths. . . . . 21. P. clandestinum

16. Spikelets 3.2-3.7 mm long; sheaths not bristly; secondary panicles exserted. . . . . 22. P. latifolium

15. Leaf blades usually less than 1 cm wide; sheaths of primary culm leaves often bristly.

17. Leaves conspicuously pubescent on both surfaces.

18. Spikelets 3.4-4.2 mm long. . . . . 20. P. leibergii

18. Spikelets 2.5-3.2 mm long. . . . . 16. P. wilcoxianum

17. Leaves glabrous at least on the upper surface, or at the most with a few scattered or marginal long hairs above.

19. Sheaths bearing a mixture of stout papillose hairs interspersed with fine fuzz.

20. Spikelets 3.4-4 mm long. . . . . 19. P. oligosanthes

20. Spikelets 2.2-2.8 mm long. . . . . 15. P. commonsianum var. euchlamydeum

19. Sheaths with papillose hairs only, or nearly glabrous.

21. Spikelets 2.9-3.5 mm long. . . 18. P. scribnerianum

21. Spikelets 2.7-3 mm long. . . . . 17. P. helleri

1. Panicum dichotomiflorum Michx. Fig. 135; Map 144.

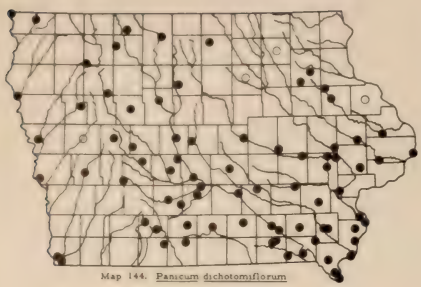
This species is a profusely-branched annual, frequently developing panicles from upper nodes of the stem. It is apparently very sensitive to environmental conditions. Given enough space, the plants become large and mound-shaped, with decumbent and rooting stems. When crowded, they are slender and erect. Vigorous plants have zig-zag stems with inflated sheaths. Fields, waste ground, gardens, shores; very common. August-October.

Chromosome number S=36 (Brown, 1948); 54 (Gould, 1958).

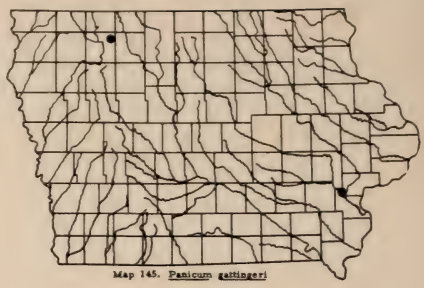
Nova Scotia to Florida, westward to Minnesota, Nebraska and Texas; occasional in the western states.

2. Panicum flexile (Gatt.) Scribn.

This species is not known from Iowa on the basis of authentic specimens (See list of excluded species), but occurs in neighboring states and may be sought here in damp, calcareous areas.



Map 144. Panicum dichotomiflorum



Map 145. Panicum gattingeri

135

136

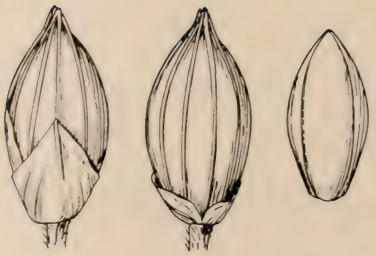


Figure 135. Panicum dichotomiflorum

Figure 136. P. gattingeri

3. Panicum gattingeri Nash Fig. 136; Map 145.

Tufted, sprawling annual. This species resembles P. capillare, but is rare in Iowa. Marshes; Clay and Louisa Counties. August.

New York to North Carolina, westward to Minnesota and Arkansas.

4. Panicum philadelphicum Bernh. ex Trin. Fig. 137; Map 146.

Annual, tufted. Rare; Clay, Hancock, Monroe and Montgomery Cos. August-September.

Chromosome number S=18 (Brown, 1948).

Connecticut to Georgia, westward to Minnesota and Texas.

5. Panicum capillare L. Witchgrass Fig. 138; Map 147.

Annual, tufted. The large, coarse plants become much-branched and bushy. At maturity the panicles may break from the plants and become tumbleweeds. Very common and widely distributed in fields and waste places, on disturbed soil. July-October. Small plants with the base of the panicle exserted have been called var. occidentale Rydb.

Chromosome number S=18 (Avdulov, 1931).

Quebec and Maine to Florida, westward throughout the United States and southern Canada.

6. Panicum hillmanii Chase Fig. 139; Map 148.

Annual, tufted, bushy. The plants greatly resemble small individuals of P. capillare. The lunate scar at the base of the fruit is characteristic. This southwestern species is known in Iowa only at the following locality. At this spot, it grew near a grain elevator with Leptochloa fascicularis, another species common to the Great Plains. The two may have come in with grain shipments.

Pocahontas Co.: Open ground, railroad yard, Pocahontas. Richard W. Pohl 6932. July 23, 1950 (ISC).

Kansas to Texas; California.

7. Panicum miliaceum L. Proso Millet Fig. 140; Map 149.

Proso is a coarse, hairy annual formerly raised as a crop. All of our specimens appear to be escapes from cultivation. The plant has not been collected in Iowa since 1921 and is probably no longer grown as a commercial crop in the state. June-September. Introduced from Europe.

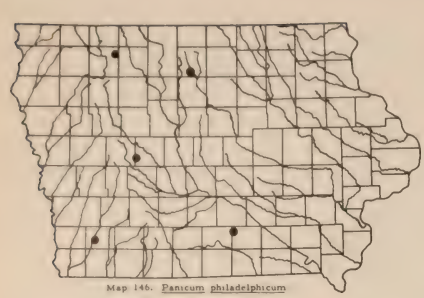
8. Panicum virgatum L. Switchgrass Fig. 141; Map 150.

Rhizomatous perennial. Switchgrass was one of the dominant grasses of the tall grass prairie and was abundant throughout Iowa. It was an important source of forage and prairie hay. It is still common on open sites, particularly prairie remnants and stream banks. July-September.

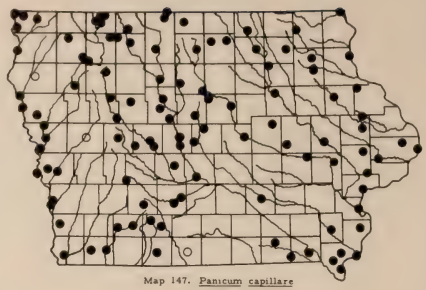
Chromosome numbers S=18, 21, 36, 54, 72, 108 (Nielsen, 1944); 21, 25, 30, 32 (Brown, 1948).

This species has many morphological, physiological and cytological strains.

Nova Scotia to Ontario and North Dakota, southward to Florida, Nevada, and Central America.



Map 146. Panicum philadelphicum



Map 147. Panicum capillare

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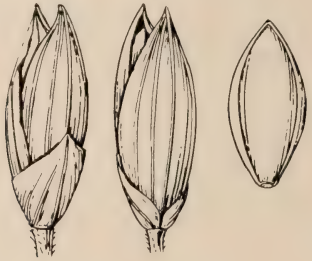

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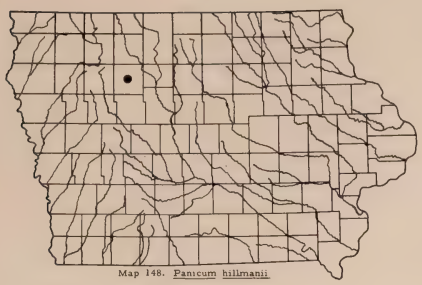
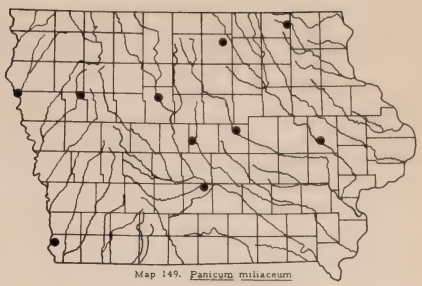
Figure 137. Panicum philadelphicum

Figure 138. P. capillare



Map 148. Panicum hillmanii



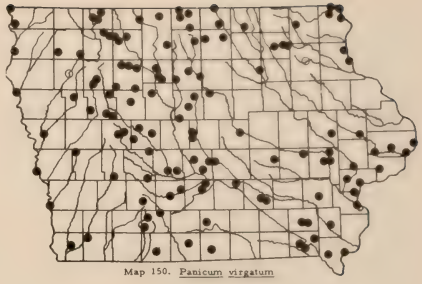
Map 149. Panicum miliaceum

Figure 139. Panicum hillmanii

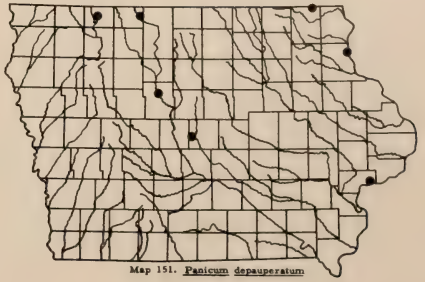
Figure 140. Panicum miliaceum

Figure 141. Panicum virgatum

Figure 142. Panicum depauperatum



Map 150. Panicum virgatum



Map 151. Panicum depauperatum

9. Panicum depauperatum Muhl. Fig. 142; Map 151.

Plants perennial, tufted, forming inconspicuous rosettes of short leaves at the base. The plants resemble those of P. perlongum, but have larger spikelets. Rare in Iowa; known mostly from the northwestern counties and along the Mississippi River.

Primary panicles in June. Secondary panicles all basal.

Chromosome number S=18 (Brown, 1948).

Quebec to Georgia, westward to Minnesota and Texas.

10. Panicum linearifolium Scribn. Fig. 143; Map 152.

Tufted perennial. The only Iowa records are based upon the following specimens.

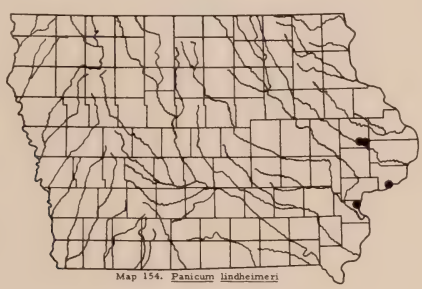
Marion Co.: Sandstone Bluff, along Des Moines River. S$\frac{1}{2}$ Sec. 3, Polk Twp. Van Bruggen 554. June 10, 1956 (IA); also S$\frac{1}{2}$ Sec. 17. Van Bruggen 2175 (IA). Wapello Co.: Sandy soil, Cliffland, Sec. 11 and 12, Keokuk Twp. June 4, 1950. R.F. Thorne 9676 (ISC, IA).

Quebec to Georgia, westward to Iowa and Texas.

11. Panicum perlongum Nash Fig. 144; Map 153.

Plants perennial, tufted, with inconspicuous basal leaves. The plants grow in small tufts among other grasses on dry, gravelly upland prairies or sandy river terraces. Fairly common in the eastern 2/3 of the state.

Primary panicles in June. Secondary panicles all basal.



Map 154. Panicum lindheimeri

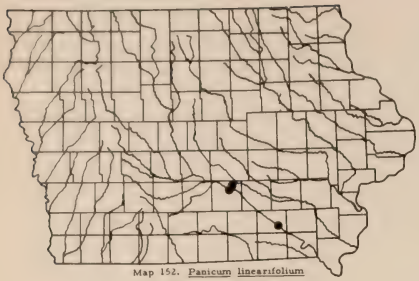
12. Panicum lindheimeri Nash. Map 154.

Perennial; producing winter rosettes. This species differs from the next not only in the glabrous character of the blades and sheaths, but also in the more elongated internodes and denser fascicles of branches. Rare on sandy or gravelly soils, along the Mississippi and major tributaries, southeastern Iowa.

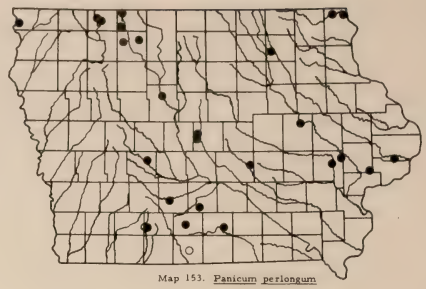
13. Panicum implicatum Scribn. Fig. 145; Map 155.

(Including P. huachucae, P. tennesseense of Hitchcock, Man. Gr. U.S.)

Perennial, forming winter rosettes. According to my interpretation, this taxon includes all of the common pubescent-leaved rosette-forming panicums with small spikelets and long ligules. There are many local strains which differ in degree of pubescence and in leaf dimensions. None of these can be satisfactorily distinguished, and all are presumably



Map 152. Panicum linearifolium



Map 153. Panicum perlongum

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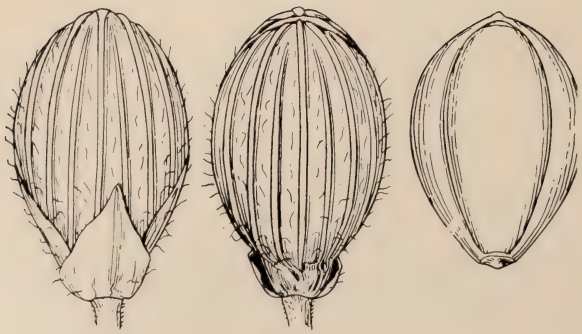
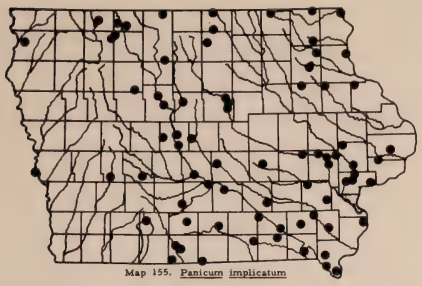
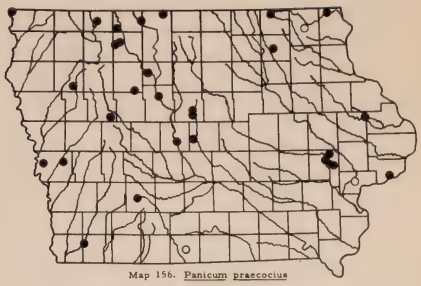


Figure 143. Panicum linearifolium Figure 144. Panicum perlongum



Map 155. Panicum implicatum



Map 156. Panicum praecocius

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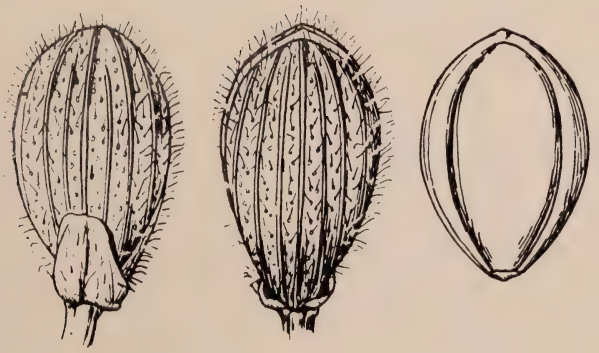

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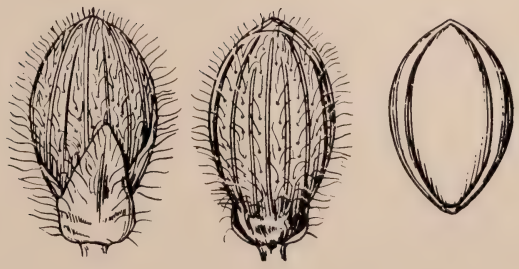


Figure 145. Panicum implicatum

Figure 146. Panicum praecocius

the result of the action of cleistogamy in producing local races. For further discussion of variation in this group, the reader is referred to Church (1929), Fernald (1934B), Shinners (1944), Pohl (1947) and Lelong (1965).

Primary panicles in June and early July.

Widespread and common in Iowa in thin woods, moist meadows, and low prairies.

Chromosome number S=18 (Brown, 1948, as P. huachucae and P. tennesseense).

14. Panicum praecocius Hitch. and Chase Fig. 146; Map 156.

Perennial, tufted, forming winter rosettes. This is the common pilose Panicum of our prairies. It is recognizable by the extremely long (3-5 mm) abundant erect pubescence on the sheaths and leaf blades, and by its habit of branching at the middle culm nodes very early, about the time of flowering of the primary panicles. The specific name refers to this trait. After the flowering of the primary panicles, they usually break off. The late season plants are very bushy at the top because of the dense fascicles of leaves on the secondary branches.

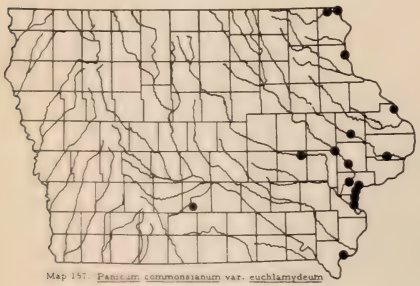
Dry upland prairies. Primary panicles in June. Widespread in northern and eastern Iowa but apparently rare or little collected in the southwestern half of the state.

Michigan and Indiana to North Dakota and eastern Texas.

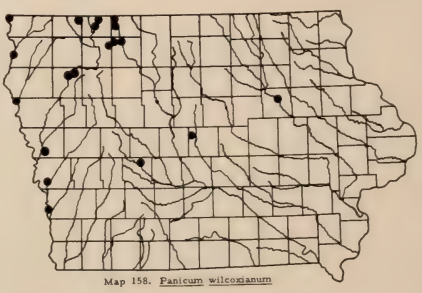
15. Panicum commonsianum Ashe var. euchlamydeum (Shinners) Pohl Am. Midl. Nat. 38:506-509 (1947). Map 157.

Perennial, forming winter rosettes. This taxon, a post-pleistocene migrant into the interior of the United States, occupies sand plain areas which are associated with the glacial drainage pattern. In Iowa, it has been collected only along or near the Mississippi River and in Warren Co. Primary panicles in May and June.

Eastern Minnesota and Iowa to Wisconsin and Illinois, eastward along the Great Lakes shores to Erie, Pennsylvania.



Map 157. Panicum commonsianum var. euchlamydeum



Map 158. Panicum wilcoxianum

16. Panicum wilcoxianum Vasey Map 158.

Plants perennial, tufted, forming winter rosettes of short basal leaves. The short, much-branched plants are similar to those of P. perlongum but lack the basal panicles of the latter. Occasional on dry upland prairies and loess bluffs, mostly along the Missouri River and in the lake region of northwestern Iowa. Possibly of hybrid origin.

Primary panicles in late May and June.

Manitoba to Illinois, westward to Alberta, Colorado and New Mexico.

17. Panicum helleri Nash Map 159.

Perennial; forming rosettes. This species is similar to P. scribnerianum but has smaller spikelets. It tends to be taller and more slender than the latter species. We have only the following Iowa specimen:

Polk Co.: Sec. 24, Saylor Twp. Sandy bank on east side of 14th St. Hwy. 69. Branches reclining on sand. Ada Hayden 8023. July 15, 1937 (ISC).

Chromosome number S=18 (Gould, 1958).

Iowa to Louisiana and westward to New Mexico.

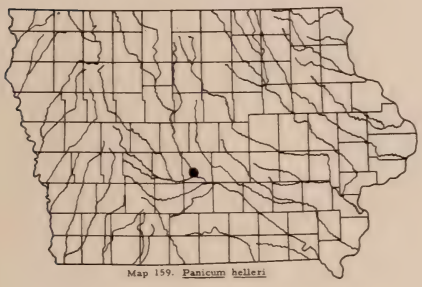
18. Panicum scribnerianum Nash Fig. 147; Map 160.

Perennial; forming winter rosettes. This is one of the commonest species of the genus on prairies, particularly in dry or sandy sites. It also occurs on roadsides and loess bluffs. Widely distributed in the state. The primary panicles are produced from late May to early July.

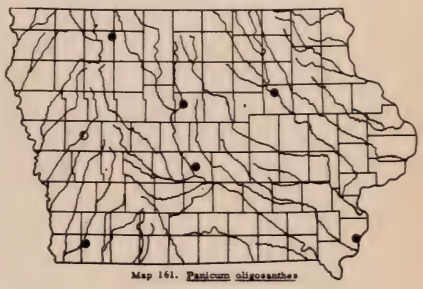
Spikelets in our specimens range from 2.9-3.6 mm long. The plants vary in pubescence, some individuals having nearly glabrous sheaths and others being heavily papillose-hispid.

Chromosome number S=18 (Brown, 1948).

Widespread in the U.S. and southern Canada; absent from the Southeastern U.S.



Map 159. Panicum helleri



Map 161. Panicum oligosanthes

19. Panicum oligosanthes Schult. Map 161.

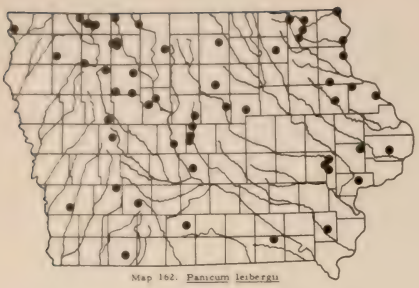
Tufted perennial forming winter rosettes. Scattered through Iowa, in grassland and open woods. Primary panicles in June. This species is similar to P. scribnerianum, differing in the presence of duplicate pubescence and slightly larger spikelets.

Chromosome number S=18 (Brown, 1948).

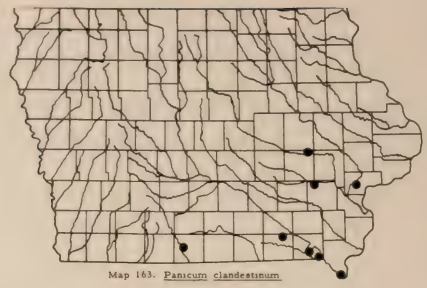
20. Panicum leibergii (Vasey) Scribn. Fig. 148; Map 162.

Perennial from a winter rosette. Spikelets 3.3-4.0 mm long. Primary panicles produced from the end of May to early July, the plants later becoming somewhat bushy. Common on prairies and dry open woodlands; not recorded from the counties along the Missouri River.

New York and western Pennsylvania to Manitoba and Kansas; Texas.



Map 162. Panicum leibergii



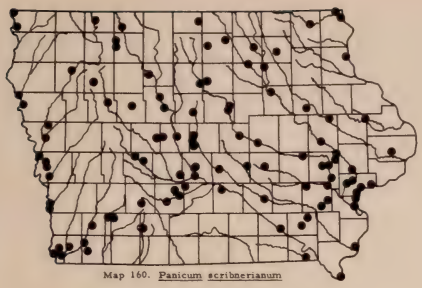
Map 163. Panicum clandestinum

148

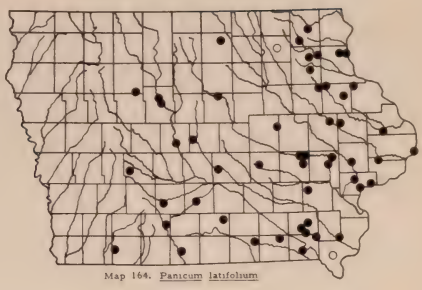
149

Figure 148. Panicum leibergii

Figure 149. Panicum clandestinum



Map 160. Panicum scribnerianum



Map 164. Panicum latifolium

Figure 147. Panicum scribnerianum Figure 150. P. latifolium

21. Panicum clandestinum L. Fig. 149; Map 163.

Perennial, forming winter rosettes. Rare and local, southeastern Iowa. P. clandestinum is a species of woodlands and brushy roadsides. The hispid secondary branch sheaths and the concealed axillary panicles are characteristic. Primary panicles in June and July.

Chromosome number S=36 (Brown, 1948).

Nova Scotia and Quebec to eastern Iowa, southward to northern Florida and Texas.

22. Panicum latifolium L. Fig. 150; Map 164

Rich woods, eastern two-thirds of Iowa. This species is probably much more frequent than our records indicate. Primary panicles in June and early July. Many of our specimens have more or less pubescent leaf blades.

Maine and Quebec to Georgia, westward to Minnesota, Kansas, and Arkansas.

58. ERIOCHLOA H. B. K.

Plants tufted; spikelets paired, in one-sided spikes; first glume forming a cup-shaped protrusion at the base of the spikelet; second glume 7-nerved, the sterile lemma 5-nerved; floret rigid, the lemma broadly ovoid, blunt, transversely rugose, with a U-shaped impression at its base (in our species), the margins slightly inrolled; palea rugose, the tip exposed.

Eriochloa villosa (Thunb.) Kunth. Fig. 151; Map 165.

Annual; spikelets about 5 mm long, puberulent; rachis copiously pilose. Introduced from Asia. Our single specimen from Iowa is listed below.

Ringgold Co.: SW $\frac{1}{4}$ of NE $\frac{1}{4}$ Sec. 4, Jefferson Twp., land of Harold Cunningham. August 8, 1957. Len R. Beath (ISC).

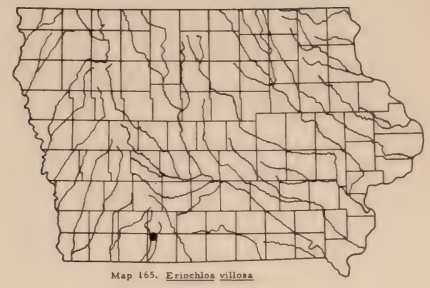
Introduced in Oregon, Colorado, Iowa, and Illinois.

59. ECHINOCHLOA BEAUV. Barnyard Grass

Plants annual, tufted; inflorescence a few-branched panicle; spikelets densely-crowded and nearly sessile, on the lower sides of the branches; first glume short, second glume and sterile lemma apiculate or awned; palea of the sterile floret well-developed; fertile floret planoconvex, the palea enclosed partly by the inrolled margins of the lemma, but its acute apex exposed; fertile lemma acuminate.

Literature

Fassett, N. C. 1949. Some notes on Echinochloa. Rhodora 51:1-3.
Fernald, M. L. 1915. Michaux's Panicum muricatum. Rhodora 17:105-7.
Reeder, John. 1956. Note on Echinochloa muricata. Rhodora 58:331-2.
Shinners, L. H. 1954. Notes on North Texas grasses. Rhodora 56:25-38.
Wiegand, K. M. 1921. The genus Echinochloa in North America. Rhodora 23:49-65.



Map 165. Eriochloa villosa

Figure 151. Eriochloa villosa

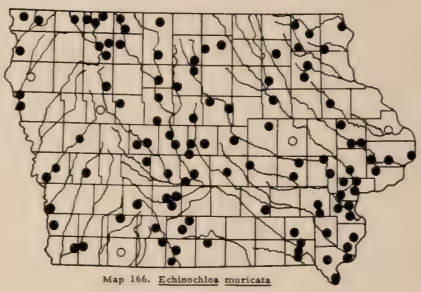
Key to Species

1. Second glume not awned or with a short awn tip; sterile lemma awnless or awned; fruiting lemma ovoid, usually 1.9-2.2 times longer than wide; sheaths glabrous.

   2. Fertile lemma tapering into a firm, beaklike tip; no minute bristles present below the tip. . . . . 1. E. muricata

   2. Fertile lemma with a soft herbaceous tip; a row of minute bristles on the coriaceous part of the lemma just below the tip. . . . . 2. E. crusgallii

1. Second glume with an awn usually several mm long; sterile lemma usually long-awned; fruiting lemma elliptical, 2.4-3.0 times longer than wide; lower sheaths usually hispid-hairy . . . . . 3. E. walteri



Map 166. Echinochloa muricata

Figure 152. Echinochloa muricata

1. Echinochloa muricata (Beauv.) Fernald Fig. 152; Map 166.

The species of Echinochloa are coarse, succulent grasses found as weeds on cultivated lands and in moist places. This species and the following one are poorly defined and there is a great deal of variation in our populations. Fernald (1915) stated that there exist in our area both a native species (E. muricata) and an introduced European one (E. crus-gallii). The two were originally separated on the basis of the hispidity of the spikelets, E. muricata supposedly having bristly spikelets and E. crusgallii lacking pustulose-based spines on the glumes and sterile lemma. Fassett (1949) pointed out an additional character which might be used to differentiate the two. This was the presence of minute stiff bristles near the tip of the fertile lemma in the European plant, and the absence of these in the supposedly native American species. Examination of the limited number of European Echinochloa specimens available to me indicates that these specimens do have such trichomes. American specimens may or may not have them. I have separated our Iowa material on the basis of this character, which does not correlate completely with glume hispidity. It would seem impossible to prove, however, that some of our plants are of European ancestry and others are native. Certainly there are no records which would tend to prove such a contention. The first Iowa specimen of E. muricata was collected by Bessey in 1871, while several sheets of E. crusgallii were collected in the state in 1887 and 1888. Thus both species have long been present in this area. It may be that all of our plants of this complex are native to North America, and that some American plants bear only a coincidental resemblance to European ones. Both forms, with and without the lemma tip trichomes, are exceedingly common and grow intermingled in the same habitats. Evidence from cytology and genetics as to the distinctiveness of E. muricata and E. crusgallii may eventually clarify this perplexing situation.

Our specimens vary in the following characters, among others:

1. Awning. Some specimens have most of the spikelets awned; others have few or no awns.

2. Number of pustulose-based spinules on the spikelets. Spikelets of some plants are conspicuously echinate; others have finely pubescent spikelets with few long trichomes.

3. Color of spikelets. Spikelets in some panicles are green or stramineous; others are red-purple to chocolate-brown.

4. Size of spikelets. Wiegand (1921) postulated two groups of varieties based upon spikelet size. Measurement of 131 specimens from Iowa showed the following distribution of spikelet lengths. Spikelets were measured with an ocular micrometer, from the point of disarticulation to the tip of the second glume. Only fully developed spikelets were measured, but terminal spikelets of each branch were avoided, since they proved to be markedly longer than others on the same plant.

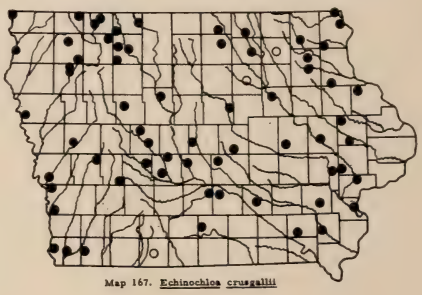
Spikelet length in Iowa specimens of Echinochloa muricata

Length in mm	No. of individuals	Length in mm	No. of individuals
3.0-3.2	5	4.6-4.8	9
3.2-3.4	9	4.8-5.0	2
3.4-3.6	19	5.0-5.2	3
3.6-3.8	22	5.2-5.4	4
3.8-4.0	7	5.4-5.6	3
4.0-4.2	19	5.6-5.8	2
4.2-4.4	11	5.8-6.0	1
4.4-4.6	13	6.0-7.6	2

These lengths do not correspond to those given by Wiegand for the varieties of E. muricata which he accepts. There is a slight indication of bimodality in the distribution of size classes.

Fields, roadsides, marshes, etc. Late June to October.

Chromosome number S=36 (Gould, 1958, as E. crusgallii var. microstachya).



Map 167. Echinochloa crusgallii

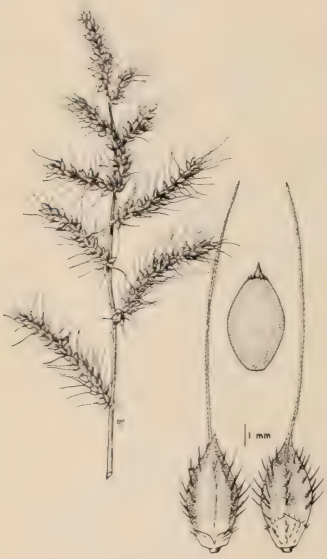
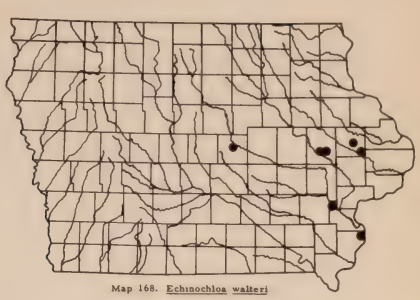


Figure 153. Echinochloa crusgallii

2. Echinochloa crusgallii (L.) Beauv. Fig. 153; Map 167.

Similar in habit and appearance to the preceding. Roadsides, ditches, marshes, cultivated fields. The spikelets are more frequently awned than those of the preceding species. Late June-September.

Chromosome numbers S=72 (Gould, 1958, as E. crusgallii var. crusgallii), 54 (Tateoka, 1954B). Other numbers are cited by authors, but probably do not refer to our strains.



Map 168. Echinochloa walteri

Figure 154. Echinochloa walteri

3. Echinochloa walteri (Pursh) Heller. Fig. 154; Map 168.

Rare, eastern Iowa, in marshes and along roadsides. Occasional plants may lack the bristly hair on the lower sheaths. Such plants have been designated as f. laevigata Wiegand. Several of our specimens are incomplete, lacking the lower sheaths. August.

Atlantic coastal plain from Massachusetts to Florida and Texas and in the Mississippi Basin to Iowa and Wisconsin.

60. DIGITARIA Heister

Tufted or stoloniferous annuals (our species); inflorescence of several slender racemes, borne in one to several whorls; or singly, at the apex of the peduncle; spikelets borne in pairs or trios on the lower side of a flattened and winged or triangular rachis. Each group is borne attached on one side of the midrib and consists of two or three unequally pedicellate spikelets. Alternate groups are borne on opposite sides of the midrib of the rachis. The spikelets lie appressed to the rachis and with their first glumes turned away from it and their fertile lemmas toward it. First glumes minute or absent; second glumes from one-half to the full length of the spikelets; sterile lemma as long as the spikelet; floret flexible; hyaline margins of the fertile lemma not inrolled.

Literature

Henrard, J. Th. 1950. Monograph of the genus Digitaria. Univ. Pers Leiden.

Key to Species

1. Rachis of racemes winged, the thin wing at least as wide as the midrib

   2. Fertile lemma gray; second glume about half as long as the spikelet; sheaths more or less hairy; spikelets paired . . . . . 1. D. sanguinalis

   2. Fertile lemma chocolate brown; second glume as long as the spikelet; sheaths glabrous or nearly so; spikelets in trios . . . . . 2. D. ischaemum

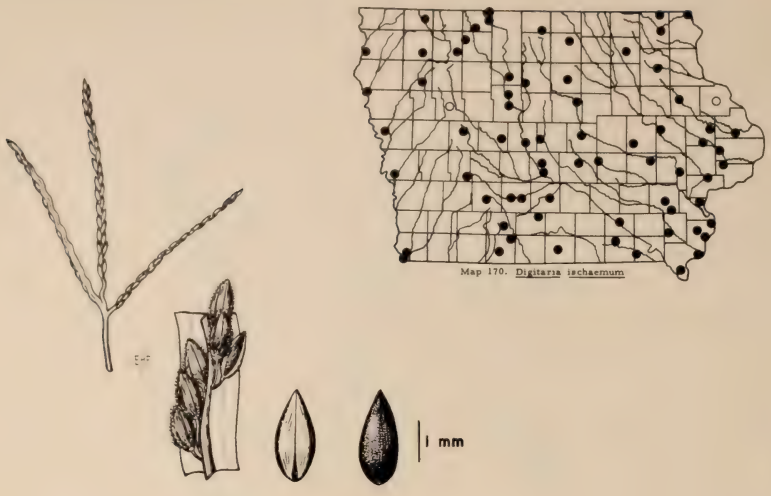
1. Rachis of racemes triangular in cross-section, without a membranous wing; spikelets in trios . . . . . 3. D. filiformis

1. Digitaria sanguinalis (L.) Scop. Hairy Crabgrass Fig. 155; Map 169.
Plant spreading, rooting at the lower nodes, eventually forming large patches. Crabgrass is one of our most troublesome weeds of lawns and gardens. The seed germinates at the onset of hot weather and the plants grow rampantly during the hot summer weather. Lawns, gardens, fields, disturbed soil. Widespread and common in Iowa. June-October.
Chromosome number S=34, 36-48 (Brown, 1948); 36 (Gould, 1963).
Widespread in the United States; native to Europe

2. Digitaria ischaemum (Schreb.) Muhl. Smooth Crabgrass
Fig. 156; Map 170.
Plants erect and tufted or spreading, the culms rooting at the lower nodes. In general this species is somewhat smaller than the preceding, with fewer and shorter racemes. The two species frequently grow intermixed. Lawns, fields, and gardens; frequent and widespread in Iowa; a bad weed. August-October.
Chromosome number S=36 (Brown, 1948).
Widespread in the United States; introduced from Eurasia.

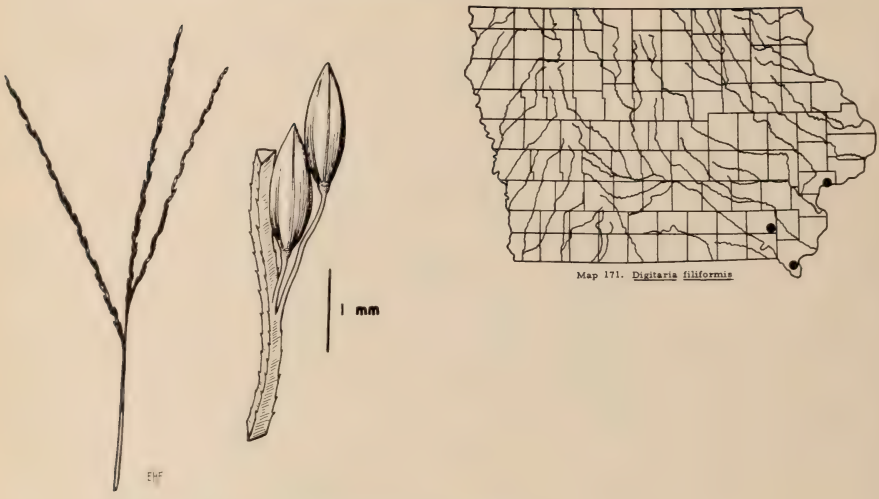
Map 169. Digitaria sanguinalis

Figure 155. Digitaria sanguinalis



Map 170. Digitaria ischaemum

Figure 156. Digitaria ischaemum



Map 171. Digitaria filiformis

Figure 157. Digitaria filiformis

3. Digitaria filiformis (L.) Koel. Fig. 157; Map 171

Rare; dry soil in southeastern Iowa. Our only records are cited below.

Jefferson Co.: Dry hillside, N. E. $\frac{1}{4}$ sec. 35, Round Prairie Twp. Oct. 5, 1935. McDonald 3042 (ISC); Muscatine Co.: Sterile knoll at Wild Cat Den. Sept. 30, 1895 (ISC). Lee Co.: Ft. Madison Shimek, Pammel; same locality, Reppert and Barnes 1895; Reppert 1898 (IA).

Chromosome number S=36 (Brown, 1948).

New Hampshire to Michigan and eastern Iowa, southward to Florida and Texas.

61. LEPTOLOMA Chase

Perennial, tufted; inflorescence a diffuse panicle, the few spikelets on very elongated flexuous pedicels; spikelets elliptic to obovate, pointed; first glume minute, less than one-tenth as long as the spikelet; second glume and sterile lemma equal, covering the floret, the sterile lemma with a short membranous palea; fertile floret coriaceous, brown; lemma with hyaline margins which overlap the palea; palea coriaceous, partially enwrapping the caryopsis. The sterile lemma and second glume bear longitudinal stripes of short hairs in the marginal internerve areas.

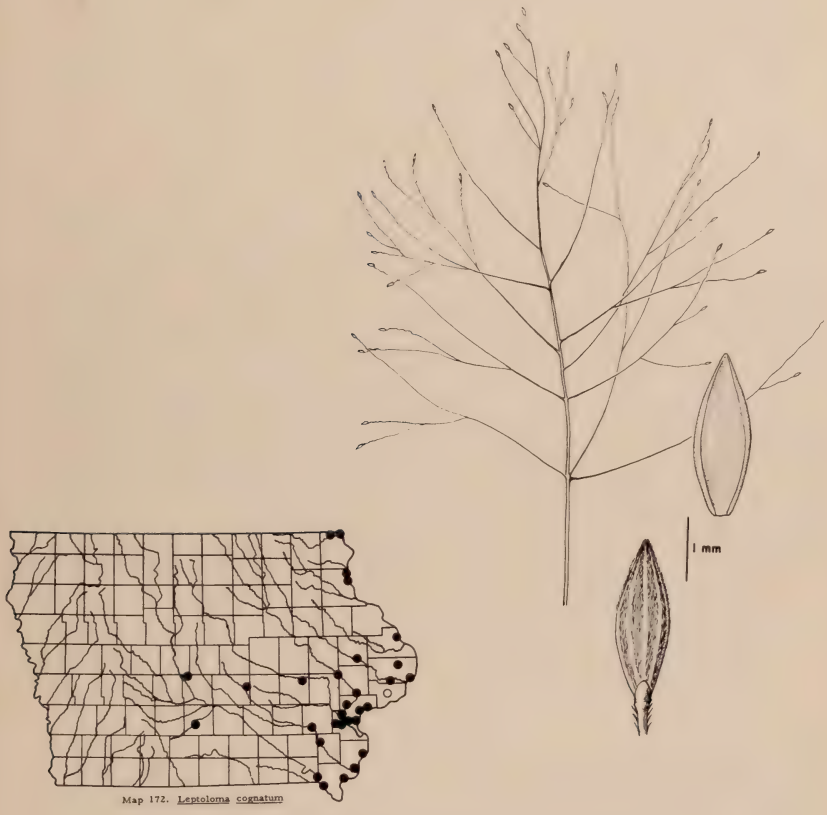


Figure 158. Leptoloma cognatum

Leptoloma cognatum (Schultes) Chase Fig. 158; Map 172.

Occasional on sandy plains, mostly along the Mississippi River, in eastern Iowa, occasional in south-central Iowa. July-September.

Chromosome number S=36 (Brown, 1948), 72 (Brown, 1951), 36, 70, 72 (Gould, 1960). Southern New England to Florida; westward to Arizona and northern Mexico, northward in the Mississippi Basin to Ohio, Michigan and Minnesota.

62. PASPALUM L.

Plants perennial; ours from a knotty crown; inflorescence of one or more one-sided racemes; rachis flattened or triangular, bearing usually paired spikelets on short pedicels on the lower side; first glume lacking or rudimentary; second glume and sterile lemma completely covering the floret; spikelets plano-convex, oriented with the convex (fertile lemma) side toward the rachis. Fertile floret hard, the margins of the lemma inrolled over the edges of the palea.

Literature

Fernald, M. L. 1934. Some transfers in Digitaria and Paspalum. Rhodora 36:19-22.

Murley, M. 1944. Paspalum in Iowa. Iowa Acad. Sci. Proc. 51:237-239.

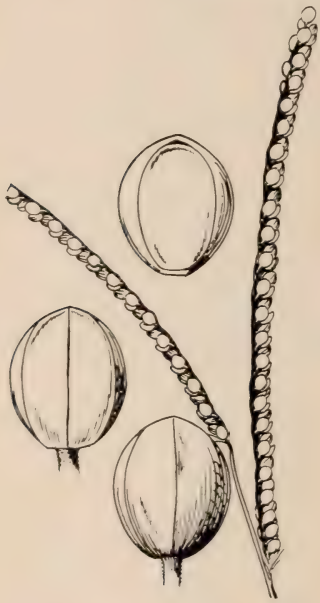
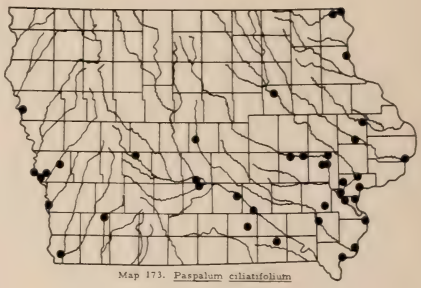


Figure 159. Paspalum ciliatifolium



Map 173. Paspalum ciliatifolium

Paspalum ciliatifolium Michx. Fig. 159; Map 173.

Including P. stramineum Nash, P. muhlenbergii Nash, and P. pubescens Muhl., as to Iowa plants.

Sandy soil and dunes, loess bluffs, prairies and roadsides. Occasional in the southern third of the state and northward along the Mississippi to Allamakee Co., Woodbury Co. Late June-September.

P. ciliatifolium is a complex of intergrading forms, sometimes regarded as separate species, which occupy all of southeastern U.S., extending northward to southern New England and southwestward to Arizona. Even in our limited area a great deal of variation is evident in the following characters, among others:

1. Leaf hairs.
   Presence or absence of fine puberulence on leaf surfaces.
   Presence or absence of long trichomes on the leaf surfaces.
2. Leaf width.
3. Presence or absence of glandular hairs on the spikelets.

Chromosome numbers S=20 (Burton, 1940), 60 (Brown, 1948, as P. pubescens Muhl.).

63. SETARIA Beauv. Foxtail

Plants annual or perennial, tufted or rarely rhizomatous; panicles dense, with abundant sterile branches (bristles) interspersed with the spikelets. First glume short; second glume and sterile lemma usually covering the floret, or the tip of the fertile lemma somewhat exposed; disarticulation below the glumes except in S. italica; spikelets falling from from the bristles, which remain on the axis.

Literature

Pohl, Richard W. 1951. The genus Setaria in Iowa. Iowa State J. Sci. 25:501-508.

_____. 1962. Notes on Setaria viridis and S. faberi (Gramineae). Brittonia 14:210-213.

Rominger, J.M. 1962. Taxonomy of Setaria (Gramineae) in North America. Illinois Biol. Mon. 29. Univ. of Illinois, Urbana.

Key to Species

1. Bristles of the panicle upwardly barbed; lower internodes of the dense panicle concealed by the spikelets and bristles

   2. Sheaths with membranous entire margins, not ciliate; fertile lemma strongly wrinkled, its upper half exposed; bristles yellow

      3. Culms in large tufts from fibrous roots; plants annual; spikelets ovate (2.8) 3.0-3.4 mm long. . . . 1. S. lutescens

      3. Culms arising singly or in small tufts from knotted, brittle, much branched rhizomes; plants perennial; spikelets elliptic, 1.9-2.8 (-3) mm long. . . . . 2. S. geniculata

   2. Sheaths short-ciliate on the margins; fertile lemma wrinkled or nearly smooth, usually covered by the second glume except at the tip; bristles greenish or purple

      4. Spikelets falling entire, the fruit remaining in the glumes

         5. Blades glabrous; spikelets 1.9-2.2 (-2.4) mm long; second glume covering at least 9/10 of the fertile lemma; fertile lemma minutely papillose, stramineous or brown, often spotted dark brown. . . . . 4. S. viridis

5. Blades pubescent above or on both surfaces, rarely glabrous; spikelets (2.1-) 2.4-3 mm long; second glume covering 3/4-5/6 of the fertile lemma; fertile lemma minutely cross-ridged, stramineous or brown, never spotted. 6. S. faberi

4. Spikelets when mature disarticulating above the glumes and sterile lemma, the fruit shelling out; cultivated . 5. S. italica

1. Bristles of the panicle downwardly-barbed, adhering to objects; lower internodes of the panicles usually exposed between the somewhat distant verticils. . . . . 3. S. verticillata

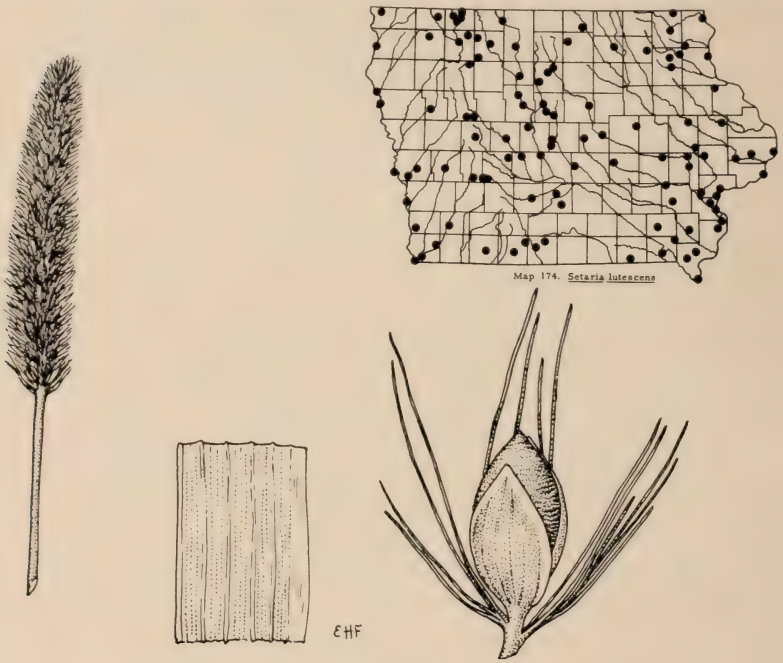


Figure 160. Setaria lutescens

1. Setaria lutescens (Weigel) F. T. Hubb. Yellow Foxtail
Fig. 160; Map 174.

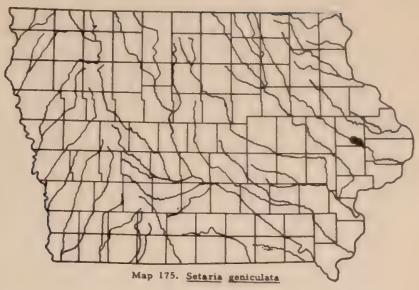
Setaria glauca Beauv., not Panicum glaucum L.

Annual; tufted. This is one of our commonest weeds, found in abundance throughout the state. It is especially abundant in cornfields, but occurs wherever the soil is frequently disturbed. July-October.

Chromosome numbers S=36, 72 (Brown, 1948).

South Dakota to eastern Texas and eastward; found to a lesser extent in the western States. Introduced from Europe.

It has been claimed that this species should be called S. glauca (L.) Beauv. Trimen (1887, p. 136) has shown that this name is based ultimately upon a specimen of the pearl millet (Pennisetum glaucum (L.) R. Br.) and is not applicable to the yellow foxtail.



Map 175. Setaria geniculata

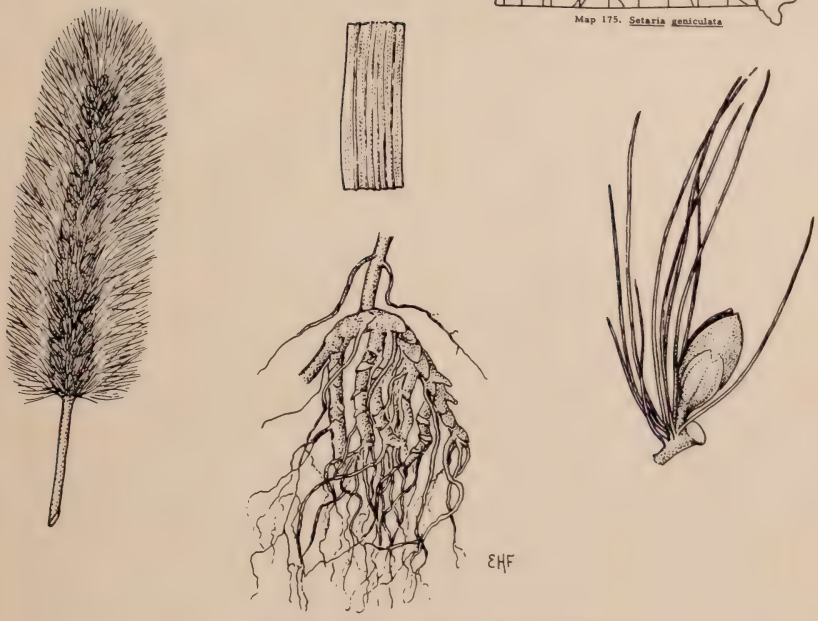


Figure 161. Setaria geniculata

2. Setaria geniculata (Lam.) Beauv. Fig. 161; Map 175.

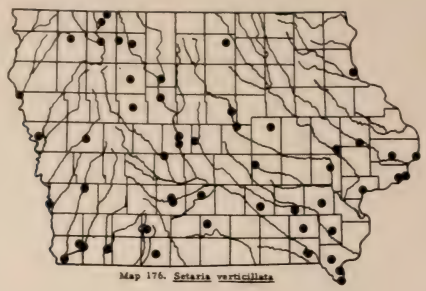
Perennial; with knotty rhizomes. This species closely resembles the previous one. Since the rhizomes are easily broken off, the plants may be confused with S. lutescens. On the average, S. geniculata tends to have shorter panicles and narrower leaves than S. lutescens. The fruits tend to be purple near the tip, whereas those of S. lutescens are straminеous.

This species is represented from Iowa only by the following two specimens. Literature reports of this species from Iowa are based upon specimens of the previous species.

Jones Co.: NW$\frac{1}{4}$ Sec. 18, Oxford Twp. Few, in a damp hollow along railroad tracks; sandy plain, bottoms of Wapsipinicon River. August 21, 1948. R. W. Pohl 6607 (ISC); SE$\frac{1}{4}$ Sec. 10, Hale Twp. R. G. Brown 349 (IA).

Chromosome numbers S=36, 72 (Gould, 1960).

Mostly on the Atlantic and Gulf Coastal Plains, northward in the Mississippi Embayment to Illinois and southeastern Iowa, southward to California, Argentina, and Chile.



Map 176. Setaria verticillata

Figure 162. Setaria verticillata

3. Setaria verticillata (L.) Beauv. Bristly Foxtail Fig. 162; Map 176.

Sprawling tufted annual. The retrorsely-barbed bristles of this species cling to any rough surface which they touch. It is common to see the panicles tangled into masses by the cohering bristles. They also adhere to hair and clothing. Common in cornfields and similar disturbed sites, but not a dominant weed. June-October.

Chromosome number S=36 (Pohl, 1962).

Massachusetts to North Dakota and California, southward to Louisiana and Alabama. Introduced from Europe.

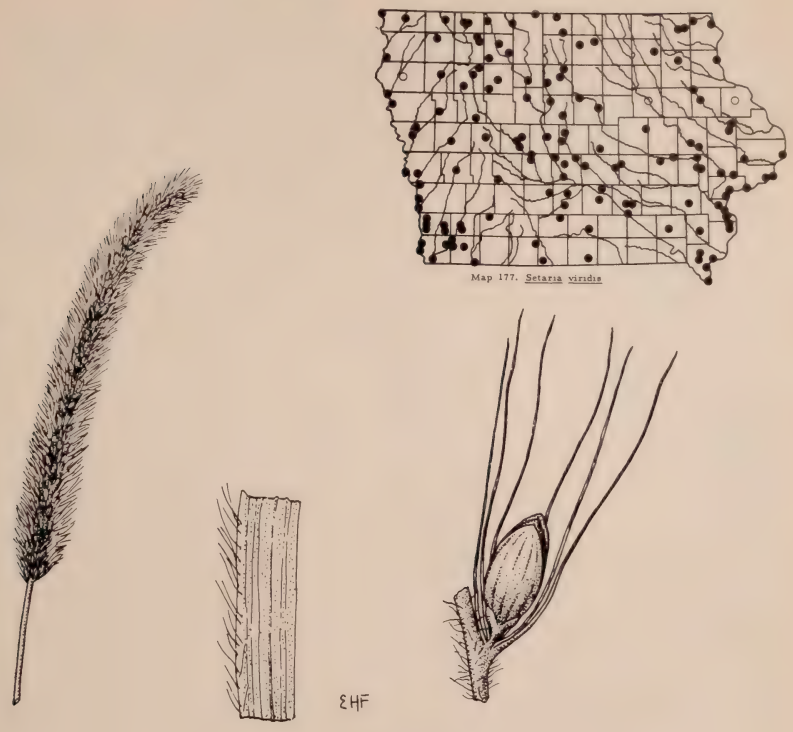


Figure 163. Setaria viridis

4. Setaria viridis (L.) Beauv. Green Foxtail Fig. 163; Map 177.

Tufted annual; extremely common throughout Iowa in cultivated fields and on other disturbed ground. The panicles are much softer than those of the preceding three species and are slightly arched or nodding. Occasional plants may have purple bristles in the panicle. July-September.

Occasionally found in stands of green foxtail are tall, vigorous, broad-leaved plants with large panicles, resembling millet except that the spikelets disarticulate below the glumes, and the panicles show little lobulation. The name S. viridis var. major (Gaud.) Posp. has sometimes been applied to these plants. Our own studies of such plants in Iowa weed populations show that some of them have nine pairs of chromosomes and are either large forms of S. viridis or aberrant forms of millet, which have lost the ability to disarticulate above the glumes. See further discussion under S. italica. Others are tetraploid (S=36). They are discussed under S. faberi.

Chromosome number S=18 (Li, Li and Pao, 1945; Gould, 1960; Pohl, 1962).

Southern Canada, southward throughout the United States. Introduced from Europe.

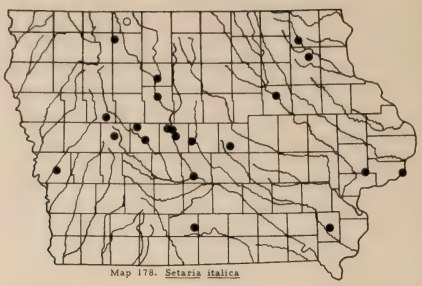

Map 178. Setaria italica

Figure 164. Setaria italica

5. Setaria italica (L.) Beauv. Foxtail Millet, Hungarian Millet, German Millet, etc. Fig. 164; Map 178.

Coarse, lush annuals; tufted; cultigens. The foxtail millets include many agronomic races, differing in color of fruits and bristles, degree of lobing of the panicles, size of plant, and other characteristics. Millet is found as an escape from cultivation, or persisting around fields. Its cultivation in Iowa has probably ceased. July-September.

Chromosome number S=18 (Li, Li, and Pao, 1945).

While millet plants may resemble those of S. viridis, Li et al. have shown that almost complete sterility exists between these two species. The morphologic differences between the two are not large, and mostly of a quantitative nature. The presence of this sterility barrier indicates that they are properly considered as independent species. The best qualitative distinction between S. viridis and S. italica is the site of disarticulation, below the glumes in the former and above in the latter. Li et al. showed that this characteristic is controlled by two pairs of complementary factors, with disarticulation below the glumes dominant. Some of the large, millet-like plants mentioned under S. viridis may have originated as the result of rare crosses of millet with the green foxtail, the offspring of which have retained the green foxtail type of disarticulation. Their frequent occurrence on agricultural land indicates the probability of such an origin.

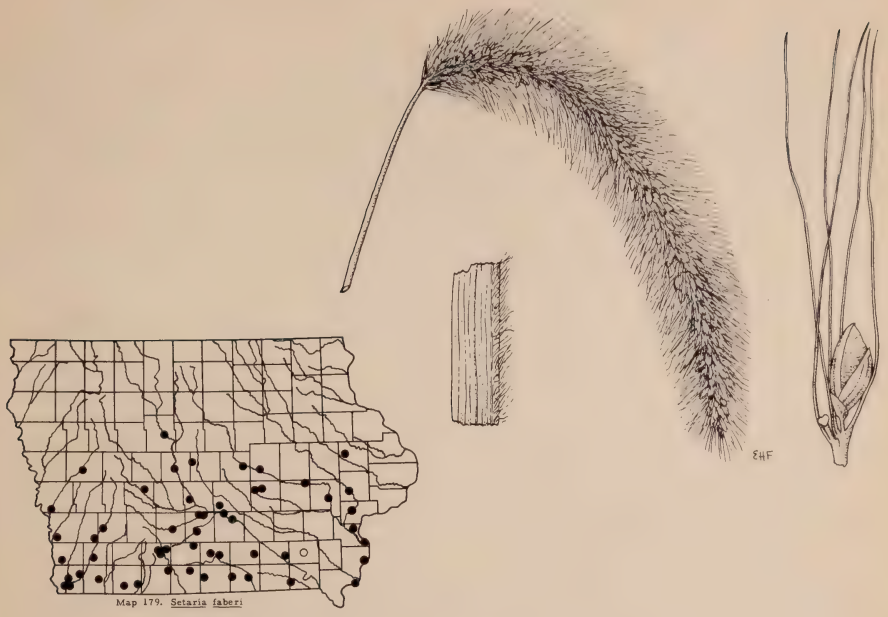


Figure 165. Setaria faberi

6. Setaria faberi Herrm. Beitrage Biol. Pflanzen 10:51 (1910).
Nodding Foxtail, Giant Foxtail. Fig. 165; Map 179.

Tufted annual; culms to 2 m tall. This species is apparently a recent invader in Iowa, the first discovery in the state being in 1949. It is now abundant in the southern counties and apparently will become a major weed pest in clean-tilled crops, particularly in soybeans. July-October.

Typical S. faberi has drooping panicles and is pubescent only on the upper surfaces of the leaves. Several variant forms have been found among our populations, however. All have typical S. faberi spikelet characters and so far as they have been cytologically investigated, have the same chromosome number as typical S. faberi. These aberrant types are listed below:

1. Plants having leaves pubescent on both surfaces; panicles often lobed.
2. Plants having leaves glabrous on both surfaces. These plants usually grow mingled with the above form.
3. Plants similar to 1 or 2 above, with small spikelets, 2.1-2.4 mm long.

Wild seed collected from hairy plants has produced occasional glabrous seedlings, and seed collected from the glabrous plants has similarly produced some pubescent seedlings. The exact nature of inheritance of these traits has not been determined.

Chromosome number S=36 (Kishimoto, 1938; Pohl, 1962).

S. faberi is native to Asia. It is now widespread in eastern and midwestern U.S.

64. CENCHRUS L. Sandbur

Plants erect or decumbent, the culms sometimes rooting at the nodes; inflorescence a spike of spiny burs, which drop from the rachis. Burs containing one to several sessile spikelets. The bur is morphologically a fascicle of fused sterile inflorescence branches, whose tips form the spines. The bur is cleft on both sides nearly to the base, exposing the upper portions of the spikelets. The spines are retrorsely barbed and can cause painful flesh wounds. Spikelets are similar to those of Panicum species; first glume reduced; second glume and sterile lemma about as long as the spikelet; sterile lemma with a well-developed palea; fertile lemma hard, with a prominent U-shaped ridge on the dorsal surface at the base; lemma tapering to an acuminate apex; palea overlapped by the edges of the fertile lemma. The burs disarticulate readily from the plants, the spikelets being retained in the burs. Germination occurs within the bur, which may often be found attached to the plant.

Literature

Delisle, D. 1963. Taxonomy and distribution of the genus Cenchrus. Iowa State J. Sci. 37:259-351.

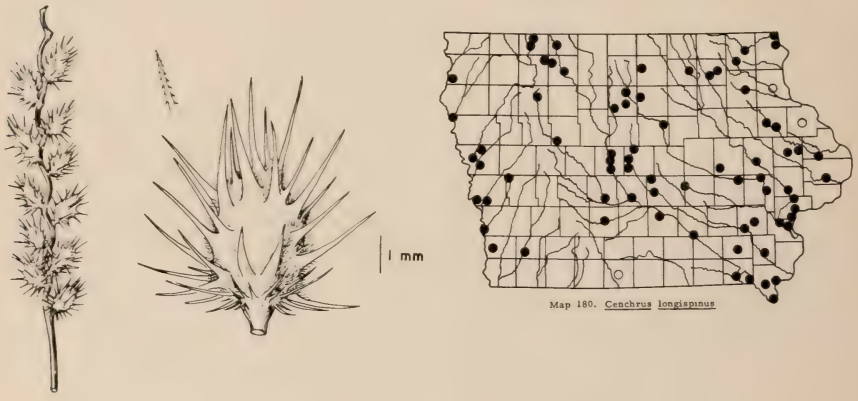


Figure 166. Cenchrus longispinus

Cenchrus longispinus (Hack.) Fern. Sandbur Fig. 166; Map 180.
C. pauciflorus of Am. authors, not Benth.

Annual; culms erect or commonly decumbent and rooting at the lower nodes. Disturbed soil, especially on sand; roadsides, lawns and pastures, fields, loess bluffs, lake shores. Widespread and common. July-September, rarely earlier.

Chromosome numbers S=36 (Brown, 1948); 34 (Gould, 1958; DeLisle, 1963).

Massachusetts and Ontario to Washington, southward to Florida and Mexico; southern South America.

TRIBE 20. ANDROPOGONEAE

65. MISCANTHUS Anderss.

Perennials; inflorescence vase-shaped, of several slender racemes borne upon a persistent rachis, racemes bearing a pair of unequally-pedicellate fertile spikelets at each node; glumes equal, membranaceous, bearing numerous long, silky hairs at the base and on the back; sterile lemma, fertile lemma, and palea very thin and delicate, shorter than the glumes.

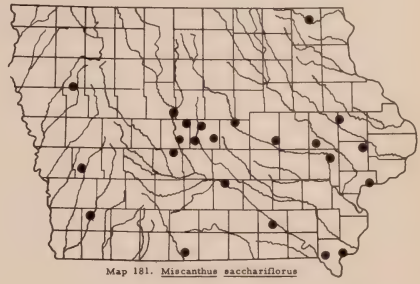

Map 181. Miscanthus sacchariflorus

Figure 167. Miscanthus sacchariflorus

Miscanthus sacchariflorus (Maxim.) Hack. Fig. 167; Map 181.

This handsome ornamental grass had been cultivated in Iowa and occasionally escapes to the wild. The culms range from 1-2.5 m in height. The silky inflorescences are lustrous white. The spikelets do not possess awns. The plants produce numerous long coarse scaly rhizomes. Ditches and roadsides, mostly on bottomlands. The plants are commonly seen along roads in southeastern Iowa. This species spreads aggressively and may become a bad weed. Introduced from Asia. September, October. Chromosome numbers S=57, 76, 95 (Adati, 1958).

66. ANDROPOGON L. Bluestem

Perennial grasses; tufted or rhizomatous; inflorescences of one or more rames*, each consisting of a jointed axis bearing numerous pairs of spikelets. Each pair of spikelets consists of a sessile spikelet with a pedicellate spikelet which is staminate or rudimentary. At maturity the axis disarticulates below the base of each sessile spikelet. Each separate segment consists of a sessile spikelet, a pedicellate spikelet, and one internode of the rachis. Internodes, pedicels, and often spikelets are long-hairy. Spikelets with stiff glumes, the first flattened, the second keeled; sessile spikelets with an awned lemma, the awn protruding from the tips of the glumes; pedicellate spikelets awnless. Sterile and fertile lemmas thin and delicate, completely enclosed by the elongated glumes.

Key to Species

1. Rames single on each peduncle. . . . . 1. A. scoparius

1. Rames two or more on each peduncle.

   2. Pedicellate spikelet about as long as the sessile one, staminate; rachis joints flattened, the hairs not more than 10 times as long as the width of the internodes

      3. Plants tufted; rachis joints and pedicels fringed with white or grayish hairs. . . . . 2. A. gerardii

      3. Plants bearing long rhizomes; rachis joints and pedicels densely covered with long yellowish hairs. . . . 3. A. hallii

   2. Pedicellate spikelet reduced to a very small rudiment or absent; rachis joints very slender, bearing copious hairs at least 20 times as long as the width of the internodes . . . . . 4. A. virginicus

1. Andropogon scoparius Michx. Little Bluestem Fig. 168; Map 182.

Perennial; tufted. Little bluestem was once one of the principal prairie grasses in Iowa. It grows on prairies, loess bluffs, and open dry wooded slopes. It has persisted well along roads and railroad rights-of-way, and at present is probably one of the most common and widely dispersed prairie grasses in the state. In general, this species is more tolerant of dry soil than A. gerardii and will be found on higher, dryer sites than the latter. Both glabrous and pubescent foliage types are

* The word rame (from the Latin ramus, a branch) is here used to indicate one of the characteristic inflorescence branches of the Andropogoneae, which have been variously called "spikes" or "racemes." Since they bear both sessile and pedicellate spikelets, neither term can be used without doing violence to its original meaning.

Figure 168. Andropogon scoparius

found in the state, without apparent differences in geographic distribution. August-September.

Chromosome number S=40 (Hunter, 1934).

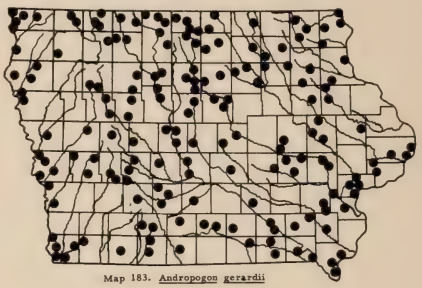
Quebec to Florida, westward to Alberta and Arizona.

2. Andropogon gerardii Vitman Big Bluestem Fig. 169; Map 183.
A. provincialis Lam.
A. furcatus Muhl.

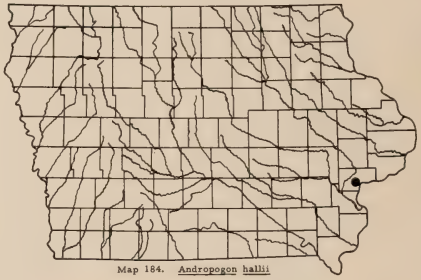
Perennial; tufted. Big bluestem was one of the dominant prairie grasses in Iowa, especially on moister and more level prairie. It furnished a great deal of prairie hay and still persists abundantly along roads and railroads. The spikelets are quite variable in color and pubescence. Most of our specimens have somewhat glaucous glumes and a few are strongly whitened. The glumes are usually nearly glabrous, but may be scabrid or sparsely hirsute. Late July-October.

Chromosome numbers S=40, 60 (Church, 1940); 60, ca. 84, 86 (Gould, 1956).

Quebec to Florida, westward to Saskatchewan, Arizona, and Mexico. Most abundant in the prairie states.



Map 183. Andropogon gerardii



Map 184. Andropogon hallii

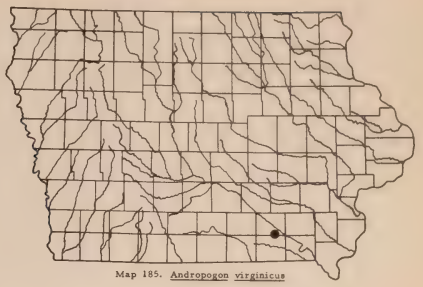
Figure 169. Andropogon gerardii

3. Andropogon hallii Hack. Sand Bluestem Map 184.

This species is a rhixomatous perennial characteristic of the sand hills of the Great Plains. It has been collected as an apparent waif on sand plains of Muscatine County. No recent specimens from Iowa have been seen and none of our other material approaches A. hallii.

Muscatine Co.: Muscatine. Barnes and Miller, year 1896 (ISC); C. R. I. & P. track near Fairport. Barnes and Miller, without date, ISC No. 87128 (ISC).

Chromosome number S=60 (Gould, 1956).



Map 185. Andropogon virginicus

Figure 170. Andropogon virginicus

4. Andropogon virginicus L. Broomsedge Fig. 170; Map 185.

Tufted; perennial. A. virginicus is widespread in the eastern United States but is known in Iowa by the single specimen cited below. It may probably be found elsewhere in southeastern Iowa. Poor soils, abandoned fields and open ground.

Wapello Co.: Clay slopes of hills bordering woods along Soap Creek about $2\frac{1}{2}$ miles northwest of Floris. Nov. 16, 1941. A. Hayden 8446 (ISC).

Chromosome number S=20 (Church, 1940).

Massachusetts to Florida and the West Indies, westward to Michigan, Iowa, and Texas. An exceedingly polymorphic species, running into many geographic races.

67. SORGHUM Moench

Spikelets in short rames, paired; each pair consisting of an awned sessile perfect spikelet and an awnless pedicellate staminate spikelet. Terminal segment of the rames bear a sessile fertile spikelet and two pedicellate staminate spikelets. Perfect spikelets broadly ovoid, with two equal coriaceous obscurely-nerved glumes longer than the floret and entirely concealing it except the awn; sterile lemma, fertile lemma and palea thin and delicate; fertile lemma lobed at the apex, the awn arising between the lobes; lodicules ciliate; staminate spikelet with two equal membranaceous, conspicuously-nerved glumes; floret one; lemma and palea thin and membranaceous.

Key to Species

1. Plant coarse, resembling corn, with thick, pithy culms; leaves 2-several cm wide. . . . . 3. S. vulgare

1. Plant not corn-like, culms seldom more than 1 cm thick, leaves long and narrow, usually less than 1.5 cm wide

   2. Spikelets disarticulating readily from the rachis and pedicels, leaving a smooth, cup-shaped apex behind; plants rhizomatous, perennial; weed. . . . . 1. S. halepense

   2. Spikelets breaking from the rachis or pedicel, with the broken stub remaining attached at the base of the spikelet, leaving an irregularly broken stalk on the plant; plants tufted cultivated annuals. . . . . 2. S. sudanense

1. Sorghum halepense (L.) Pers. Johnson Grass Fig. 171A; Map 186.

Johnson grass, a tall perennial, is a serious weed pest in clean-tilled crops in the South. In Iowa, it apparently is not winter-hardy except in the extreme southwest corner of the state. It is occasionally found on the Missouri River bottomlands around Hamburg and at a few other sites in extreme southern Iowa. It was also cultivated experimentally at Ames many years ago, but apparently has not persisted.

Chromosome numbers S=20, 40 (DeLay, 1951); 40 (Gould, 1956).

July-October. Introduced from the Old World. Massachusetts to Wyoming and southward.

2. Sorghum sudanense (Piper) Stapf. Sudan Grass Fig. 171B.

Sudan grass is extensively cultivated as an annual forage crop. In general appearance it resembles Johnson grass, but can be distinguished by the characters given in the key. At times this species, as well as other sorghums, may contain enough hydrocyanic (prussic) acid to cause death of livestock. Introduced from the Old World.

Chromosome number S=20 (Huskins and Smith, 1934).

3. Sorghum vulgare Pers. Sorghum

This is the common cultivated sorghum, which exists in many cultivated forms. Some are cultivated primarily for forage and syrup, others for grain production. Sorghums are grown to a limited but probably increasing extent in Iowa. Introduced from the Old World.

Chromosome number S=20 (Longley, 1932).

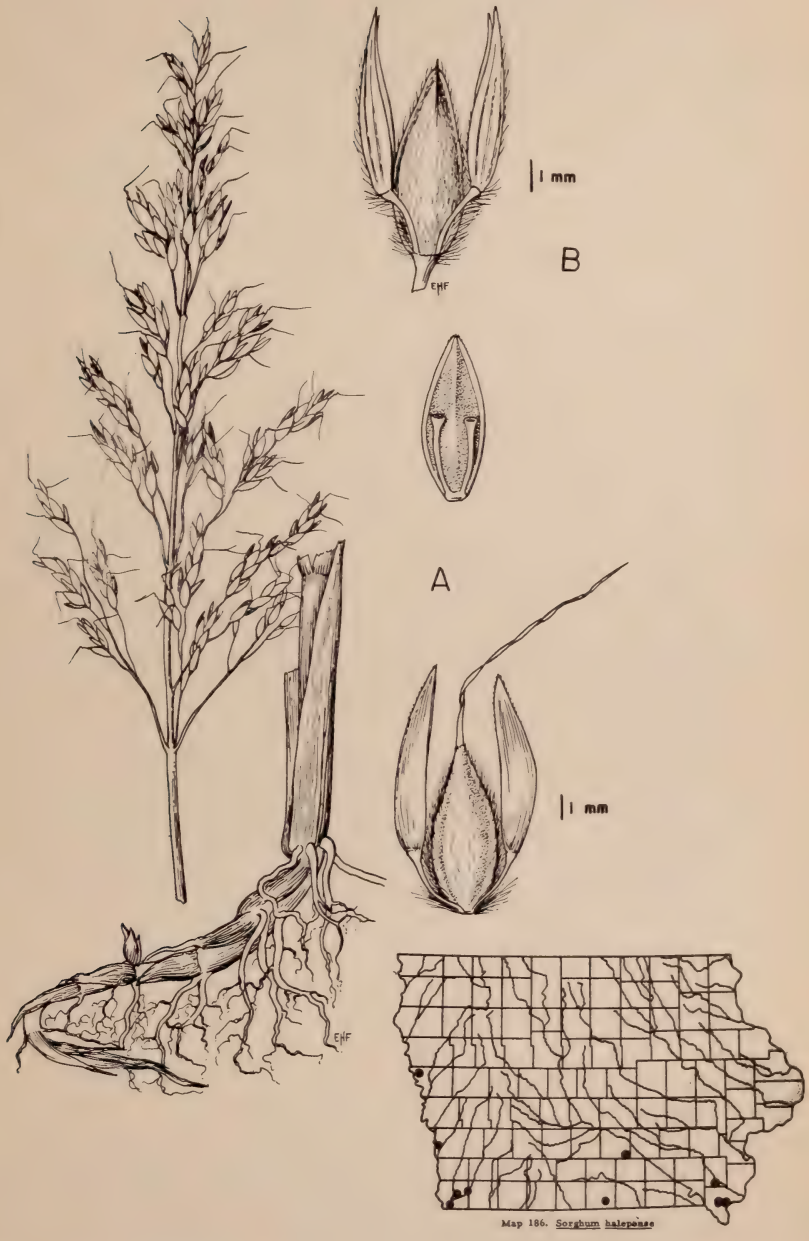
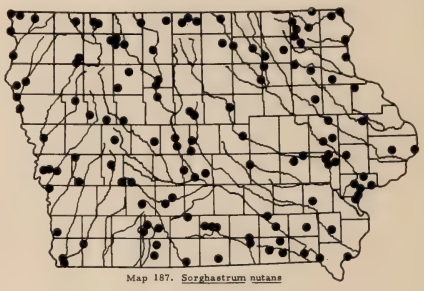


Figure 171A. Sorghum halepense

Figure 171B. Sorghum sudanense

68. SORGHASTRUM Nash

Tall perennials; inflorescence a panicle of short inflorescence units (rames), each unit consisting of one to several spikelet-bearing rachis joints. A sessile, perfect-flowered spikelet is borne at each joint of the rame, along with a hairy pedicel which normally bears no spikelet. The terminal segment of each rame bears both a sterile pedicel and a sterile rachis joint. Disarticulation is at the base of the spikelet, each spikelet falling with the hairy rachis joint and sterile pedicel attached. Glumes stiff, golden brown, hirsute, equal; first glume flattened, its edges overlapping the second; second glume boat-shaped; sterile lemma hyaline, two-keeled and lacking a midrib, nearly as long as the glumes, ciliate; fertile lemma short, hyaline, narrowly lanceolate, ciliate, two-lobed and bearing a strong twisted and bent exserted awn; palea of fertile floret minute, nerveless, translucent; lodicules fan-shaped, truncate; anthers conspicuous, golden yellow.



Map 187. Sorghastrum nutans

Figure 172. Sorghastrum nutans

Sorghastrum nutans (L.) Nash Indian Grass Fig. 172; Map 187.

Clump-forming, the culms arising from short, knotty rhizomes. Indian grass was one of the principal grasses of the tall grass prairie, and is still common along roadsides and on relict prairies. Late July-September. Chromosome number S=40 (Brown, 1950; Bowden, 1960B).

Quebec to Florida, westward to the Rocky Mountain States and Mexico.

69. TRIPSACUM L.

Plants perennial, forming large clumps, the culms arising from short, knotty rhizomes; culms tall, branching, bearing terminal and axillary inflorescences; terminal inflorescence long-peduncled, consisting of one to several spikes. Each spike consists of a bony basal portion containing the pistillate spikelets, and a terminal portion bearing staminate spikelets. The pistillate portion of the spike is made up of a series of very hard, thick rachis joints which disarticulate from the plant and from each other at maturity. Each joint is hollowed out and contains a single pistillate spikelet. The first glume of the pistillate spikelet is hard, [-shaped in cross section. It closes off the outside of the cavity containing the spikelet and its flanges nearly surround the remainder of the spikelet. The stiff second glume lines the hollow of the rachis. The sterile lemma, fertile lemma are thin and translucent. The sterile lemma has a well-developed palea.

Staminate spikelets are borne in pairs on one side of a conspicuously jointed rachis. One of each pair is sessile and the other nearly so. The first glume is coriaceous, two-keeled and partially encloses the second glume. The spikelets possess two staminate florets. The entire staminate portion of the spike is shed when the pistillate portion breaks up.

Tripsacum dactyloides L. Gama Grass Fig. 173; Map 188.

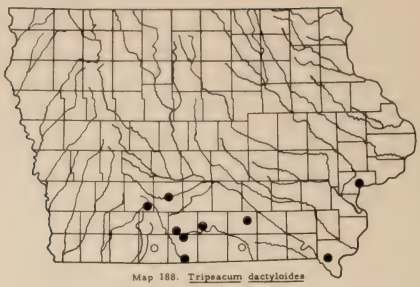
Rare in southern Iowa, from Muscatine County to Madison County and southward. Low moist ground, roadsides. July-October.

Chromosome numbers S=36, 45, 54, 72, 90, 108. Apomixis is present (Farquharson, 1955).

Massachusetts to Iowa and Nebraska, southward to Florida and Texas.

70. ZEA L. Corn, Maize

Tall stout annual; tufted but frequently suckering from the base; culms thick, pithy; plants monoecious, the staminate spikelets in a terminal panicle of rames; staminate spikelets borne in unequally pedicellate pairs, but the arrangement often greatly distorted by crowding. Each staminate spikelet has two long membranous glumes, concealing two staminate florets. Pistillate inflorescences axillary, their spikelets borne in longitudinal paired rows on a thick, hard axis, the cob, the whole ensheathed by numerous reduced leaves, the "husks" or "shucks." The paired condition of the rows on the pistillate inflorescence reflects the fact that spikelets throughout the Andropogoneae are paired. The pistillate spikelets conform to the typical panicoid type of organization in their early development, but at maturity it is very difficult to distinguish the various bracts of the spikelet, which become the chaff of the cob. In a few strains of corn, the normally sterile lower floret of each spikelet develops a grain. In such strains (Country Gentleman, etc.), rows are not evident on the ear because of extreme crowding. In corn, the two styles of the pistillate flower are fused, forming the elongated silk. The structure of the ear has been discussed at length in the literature, without unanimity of opinion. Comprehensive discussions of the structure, origin, and history of corn may be found in the following references.



Map 188. Tripsacum dactyloides

Figure 173. Tripsacum dactyloides

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Figure 174. Zea mays

Zea mays L. Corn Fig. 174.

Corn is the most important single crop in Iowa and one of the leading cereals in the world. It never grows as a wild plant, although scattered plants may develop from spilled seeds along roads and in fields.

Excluded Species

Bromus arvensis L. Specimens so cited by PBS are other species, especially B. japonicus. B. arvensis does not occur in Iowa.

B. unioloides H. B. K. (= B. catharticus Vahl). A specimen in the Iowa State University Herbarium was collected by Miss Sirine in Ames in 1890. It was probably cultivated. There are no records of any more recent occurrences of this introduced species.

B. marginatus Nees, B. marginatus var. latior Shear. Specimens so cited by PBS are various forms of the B. carinatus complex. The plants were cultivated on the College Experimental Grounds at Ames between the years 1889 and 1900, the various extant specimens apparently representing several introductions. Another specimen in the Herbarium of Iowa State Univ., cited by PBS, is Miss Sirrine's, labeled "Dysart, June 25, 1896." There is no evidence from recent collections that any of these plants have succeeded in becoming established as part of the Iowa flora.

B. racemosus L. Specimens cited by PBS as belonging to this species (under the name B. hordaceus var. glabrescens) are all other species.

B. squarrosus L. The specimen cited by PBS is B. japonicus.

B. carinatus H. and A. The single specimen cited by PBS as this species is B. purgans, f. incanus.

Eragrostis mexicana (Hornem.) Link. Listed in the eighth edition of Gray's Manual. The specimen upon which this report is based (in GH) is a duplicate of Pammel 306, which is the basis of the report of E. neomexicana from Iowa.

E. neomexicana Vasey. A specimen so named by Hitchcock is in the Herbarium of Iowa State University. It was collected by L. H. Pammel (No. 306) in Ames in 1895 and marked as an escape from cultivation. There are no later collections of this species from Iowa.

Hordeum hystrix Roth, an annual with the glumes all narrow, was found growing in a lawn in Ames in 1961. The seed apparently was transported in bluegrass seed.

H. nodosum L. PBS report this European species from Hawarden. No voucher specimen was found, and the species has not been reported from Iowa by any recent author.

Oryzopsis hymenoides (R. and S.) Ricker. Reported from Iowa by Fernald in the eighth edition of Gray's Manual. Dr. Reed Rollins writes that there is no specimen to authenticate this record. Pammel reported this species on the basis of an old specimen, purportedly from Wall Lake, but the specimen was burned up in an early herbarium fire. Iowa is far out of range for this species, and it is unlikely that it would become established here.

Panicum auburne Ashe. Reported by Hitchcock (1950) from Emmet Co., Iowa. An apparent duplicate of the specimens on which this report was based (Wolden 1555) is in ISC. It is fairly typical P. implicatum, with spikelets 1.5 mm long.

P. deamii Hitchcock and Chase. Reported by Hitchcock on the basis of Hayden 8014 (US, ISC). The specimen is P. commonsianum, var. euchlamydeum.

P. flexile (Gatt.) Scribn. Reported by Hitchcock. Specimens so named in US (Hayden 125 and 8220) have hispid pulvini and large panicles; they are P. capillare. A Pammel specimen from Cedar Rapids (1889) in the Herbarium of the Missouri Botanical Garden, reported by Hitchcock and Chase (1910) to be P. flexile is not this species.

P. haemocarpon Ashe J. Elisha Mitchell Soc. 15:55 (1898). Ashe cited a Carver specimen from Jewell Junction (1895, No. 258) in the original description. The specimen is P. praecocius.

P. iowense Ashe, N. C. Ag. Expt. Sta. Bull. 175:115 (1900). Scarcely identifiable from the description, which calls for a plant 1-2 cm tall. The remainder of the description applies to some member of the lanuginosum complex, either P. implicatum or P. praecocius. Hitchcock and Chase (1910, p. 330) state that no identifiable type specimen exists.

P. pseudopubescens Nash. Reported by Hitchcock (1950) on the basis of a Shimek specimen from Homestead, Iowa Co. (U.S. 1538282). The specimen is P. commonsianum var. euchlamydeum. Later Iowa specimens in U.S. are the same taxon.

P. pammelii Ashe N. C. Agric. Expt. Sta. Bull. 175:116 (1900) = P. perlongum Nash. A duplicate of the type of this taxon is in our herbarium (Cratty, June 12, 1881, from Armstrong, Emmet Co.). The spikelets are 3.5-3.7 mm long, larger than Hitchcock's measurements of the Ashe specimen of the type, which he referred to P. perlongum. Our specimen is P. depauperatum Muhl.

P. scoparioides Ashe. A single specimen so named is in US. It was collected at Ames by A.S. Hitchcock in 1914 (Hitchcock 11029). The plant in general aspect resembles the locally common P. scribnerianum, but has long ligules (2-2.5 mm) and small spikelets, 2-2.2 mm long. Fernald (1950) regards these plants as probably hybrids between P. oligosanthes (scribnerianum) and a member of the lanuginosum group. This seems a reasonable explanation of this anomalous specimen.

Poa arachnifera Torr. This species, native to the southern Great Plains, was once cultivated at Ames. (PBS) There is no evidence that it has persisted.

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